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Petrography of Coal in the Houtzdale Quadrangle, Clearfield County, Pennsylvania

Edwin F. Koppe

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**Petrography of Coal
in the Houtzdale Quadrangle,
Clearfield County, Pennsylvania**

by Edwin F. Koppe

Coal Petrologist
Pennsylvania Geological Survey

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P R E F A C E

This report is the result of a study on the physical nature of coals in the Houtzdale 15-minute quadrangle, Clearfield County, Pennsylvania. The descriptions of the coals are mainly based on detailed examination of the various coals under the microscope. The report also contains previously published chemical analyses of the coals.

A brief description of each coal is presented with tables listing the microscopic components of the coals. This data, plus the individual descriptions of coal beds in the Appendix, will give the coal users and producers a clear picture of the physical nature of the coal beds in the area. The tables and detailed descriptions can assist coal users in selecting coals of particular types for their respective needs.

The detailed microscopic analyses of the coals, together with ash analyses of layers within the coal beds, show that the Houtzdale coals differ greatly from one coal bed to another as well as from top to bottom in the same bed. The analyses also show that the characteristics of a coal bed may vary from place to place within the same district. Coal operators and geologists will find that these differences help to identify and trace coals from place to place; this is of particular help where only coal samples are available from exploratory drilling. Knowledge of these physical changes may help operators in improving their product through selective mining or appropriate processing methods. The study also demonstrates that microscopic study of coal (coal petrography) is useful in correlating coals in a geologically complicated area.

It is hoped that this publication will stimulate the use and development of central Pennsylvania coals for a wider range of industrial applications.

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PETROGRAPHY OF COAL IN THE HOUTZDALE QUADRANGLE, CLEARFIELD COUNTY, PENNSYLVANIA

By
Edwin F. Koppe

ABSTRACT

Medium and low volatile bituminous coals of the Houtzdale quadrangle were studied through quantitative microscopic petrography and supplementary ash analyses to determine: 1) the maceral composition of the beds involved, 2) the lateral continuity of composition, and 3) the usefulness of this type of analysis for detailed geological correlations. Data are presented for 9 coals collected from 92 sample sites. Each coal was sampled by layers and the composition determined by reflected light microscopy of prepared crushed coal pellets. Bed totals, given for each coal, were obtained by calculations based upon the percentage of macerals in each layer as well as the percent contribution of the layer to the total coal.

Conemaugh coals (Mahoning, Upper Freeport rider) and Pottsville coal (Mercer) yield relatively low vitrinoid values and high ash concentrations suggestive of marginally economic deposits. Most of the economic Allegheny coals have high vitrinoid concentrations.

Petrography proved useful in establishing the identity of some coals over distances exceeding 4 miles. The Upper Freeport coal and some beds of the Lower Kittanning coal complex were readily identified by total coal composition. Other coal beds were more variable in composition and thus less identifiable and could only be correlated by means of individual layers within the beds.

INTRODUCTION

This report is written in an effort to help coal producers and consumers in further understanding the physical properties of medium- and low-volatile coals of Pennsylvania. Primarily, data are presented to elucidate the petrographic characteristics of coals in the Houtzdale 15-minute quadrangle. In addition, special emphasis is placed upon establishing coal petrography as a practical tool for identifying and correlating coals in problem areas.

The Houtzdale quadrangle lies west of the center of Pennsylvania mostly in southeastern Clearfield County, but partly in Centre County, as shown in Figure 1. It has an area of 225.9 square miles and is bounded by parallels North $40^{\circ} 45'$ and $41^{\circ} 00'$ and by meridians West $78^{\circ} 15'$ and $78^{\circ} 30'$. The quadrangle is divided into four named $7\frac{1}{2}$ -minute

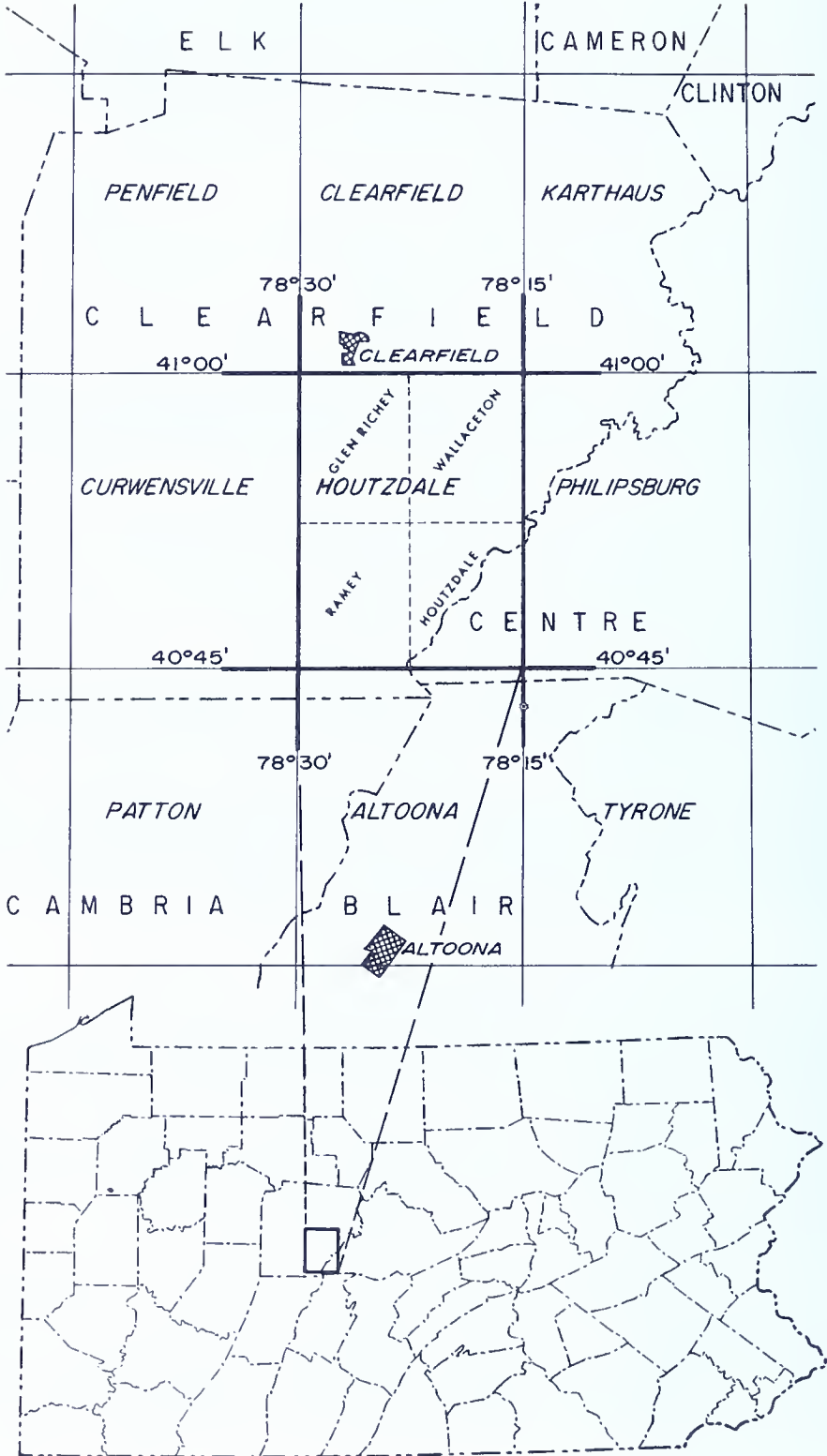


Figure 1. Location of the Houtzdale quadrangle.

quadrangles as follows: NW—Glen Richey, NE—Wallaceton, SW—Ramey, SE—Houtzdale. A large percentage of the quadrangle is underlain with valuable coals and clays. For nearly a hundred years, the coal resources have been developed by extensive underground mining and, more recently, by strip mining and auger recovery.

Geologically, the area is complex, both in sedimentary details and in structural modifications. The coal-bearing rocks are Pennsylvanian in age, as are all of the important coal strata of the Commonwealth. Virtually all of the mineable coals of the Houtzdale quadrangle are in the Allegheny Group. The Monongahela Group, which contains the important Pittsburgh coal; and the upper part of the barren Conemaugh Group are missing in this region because of erosion of the upper part of the geological section.

Although the area is not intensely folded, faulting in the eastern half of the quadrangle tends to confuse some correlations and horizontally displaces similar lithologic facies of the coal.

A thorough investigation of the geology of the Houtzdale quadrangle has been completed recently by V. C. Shepps and W. E. Edmunds. The geology of the northern and southern halves are being prepared as separate reports. For this reason only necessary stratigraphic geological information is presented in this paper.

Coal produced from the quadrangle is suitable for electrical power generation as well as for general industrial and domestic uses. It has also been used as a smithing coal and as a coking coal. A high percentage of present production is for utilization as a steam coal for electrical power generation.

Tables of published chemical analyses are included as aids for producers and users of the coal from this area.

ACKNOWLEDGEMENTS

The writer is grateful to many coal operators who provided access to the sample sites and furnished much needed information about the coal where no longer exposed. Special credit is given to Robert Sponseller, Pennsylvania Geological Survey Staff Geologist, who assisted the writer in the collection of samples, prepared all of the samples for microscopy, and assisted in accumulating published analyses of the coal.

METHODS AND PETROGRAPHIC NOMENCLATURE

Coals were collected for study from beds exposed in active and inactive strip mines, underground mines, and new road cuts. Each sample was located upon the appropriate 7½-minute topographic map and is recorded in this report to the nearest 100 feet from a 5-minute latitude

and longitude co-ordinate. For example, coal sample 85-C-23 was collected in a strip mine at a point 10,500 feet South of $41^{\circ} 00'$ and 7,500 feet West of $78^{\circ} 25'$ in the Glen Richey $7\frac{1}{2}$ -minute quadrangle. Where known, the name of the strip mine operator is recorded; however, no concerted effort was made to establish the identity of operators of inactive mines.

Channel samples were collected in the field from each megascopically recognizable layer of the coal bed being studied. Field notes included a megascopic description of the coal bed by layers and, where possible, a measured section was made of the overlying and underlying rock strata at the site.

In the laboratory, the coal was crushed to 30 mesh, pelletized in lucite, and a polished surface was prepared for microscopic analysis. A split of each layer sample was dried, and an ash analysis was made from the sample. All samples were examined under oil by plane and polarized reflected light using a Leitz Panphot microscope with 25X fluorite objective and 10X periplane oculars. The actual magnification was X310. Standard index oil of $n=1.515$ was rejected for these coals. An index oil adjusted to $n=1.600$ was prepared from a mixture of cedarwood oil and 1-bromonaphthalene to enhance reflectance differences of the coal components. The maceral group analysis (Koppe, 1960) of each sample was determined on the basis of 500 points using the Chayes method (Chayes, 1949, 1956).

Macerals are the organic coal components seen under the microscope. For simplification, analyses are reported in this paper in terms of the major maceral groups, namely vitrinoids, exinoids, micrinoids, and semi-fusinite and fusinite (fusinoids). *Vitrinoids* are composed of discrete portions of plant tissue and finely fragmented matrix material which have about the same reflectance in the gray range. Vitrinoids become plastic and release volatiles upon heating. This group encompasses the bulk of reactive material in coals. *Exinoids* are those remains of waxy spores and cuticles which retain an ability to become fluid upon heating. Exinoids, as used in this report on medium- and low- volatile coals, excludes cuticular or spore-derived substances which are metamorphosed into substances analogous to vitrinites or into highly carbonized constituents that may be relatively inert upon heating.

Micrinoids and fusinoids are the essentially inert components of coal. These substances are already highly carbonized and apparently do not react significantly when heated in a reducing atmosphere. *Micrinoids* are massive or fine highly reflective particles of metamorphosed resin rodlets, cuticles, spores, and miscellaneous inert fragments. *Fusinoids* are lenses or bands of carbonified tissues which retain vestiges of plant cellular organization. The group includes minor amounts of tissues which are more

highly carbonified than the vitrinoids but still are somewhat reactive. For this reason, the fusinoids are reported as fusinite, (highly carbonified), and semi-fusinite (the intermediate components).

The resulting microscopical data were converted to percentages on an ash-free volumetric basis. Total seam data were calculated by multiplying the individual maceral percentage of every layer by the thickness of the layers, adding the totals for each maceral and dividing the results by the total thickness of the coal bed.

STRATIGRAPHY

This report is concerned with lower coal-bearing rocks of Pennsylvanian age found in the upper part of Pottsville, the Allegheny, and the lowermost portion of the Conemaugh Groups. A generalized stratigraphic column (Figure 2) illustrates the relative position of the important coal horizons discussed. The coal horizons are identified to assist the reader in relating the findings based on coal microscopy to the overall aspects of the rocks involved.

Figure 2 shows diagrammatically that the major coals and their associated underclays rest upon uneven erosional surfaces, in some cases having pronounced relief. Uneven depositional bases of coal beds and underclays are particularly noticeable in the rocks of Clearfield County. Similar strata farther west in Pennsylvania do not have such uneven depositional bases.

Coal strata developed upon uneven erosional bases lack uniform intervals between major coal horizons. This plus splitting of the coal into several benches, and occurrence of "stray" beds beneath the major horizon, often causes confusion in correlation or bed identification and may account for erratic test results.

CONEMAUGH GROUP COALS

The Conemaugh Group in Pennsylvania seldom contains coals of widespread importance. Most are thin, present only in local pods. This is the character of the two Conemaugh coals found in the Houtzdale quadrangle. These coals, the Mahoning coal and the Upper Freeport rider coal, are found very near the base of the group (Figure 2). Neither coal has much economic value and both coals have a reputation for having a high ash content. Consequently they are frequently removed with the overburden during stripping operations which are recovering the Upper Freeport coal beneath them. Locally, in the quadrangle, either the Upper Freeport rider or the overlying Mahoning is called the "F" coal by miners. The confusion is understandable in that neither horizon is persistent in the strata. The Upper Freeport rider coal locally lies directly upon the

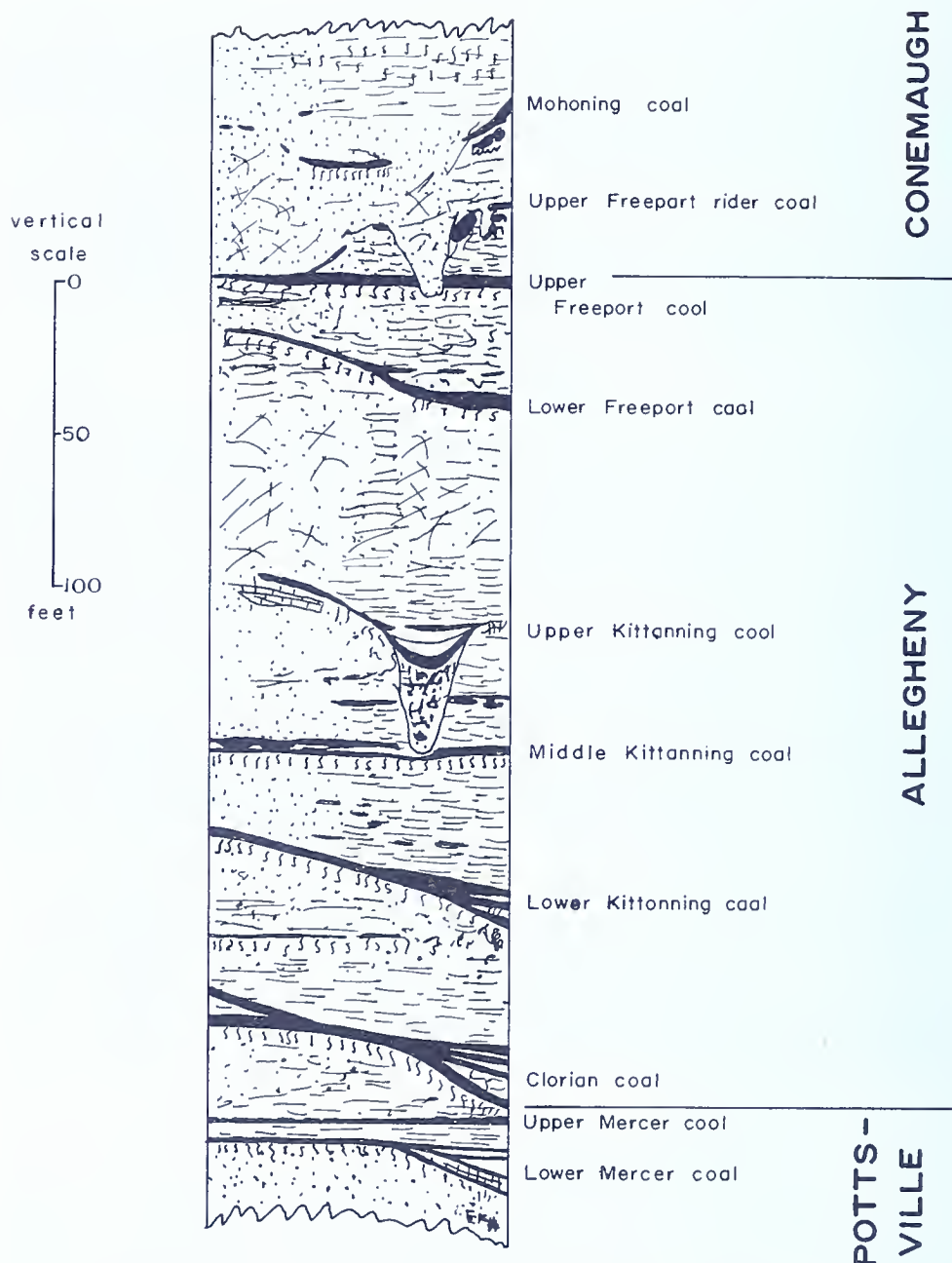


Figure 2. Generalized stratigraphic column in Clearfield County.

Upper Freeport coal in the southern part of the area. The Mahoning rarely is less than 35 feet above the Upper Freeport and more generally is found between 35 feet and 70 feet above the Upper Freeport horizon.

The data given below (Appendix, Samples 85-C-22,-38,-85) are presented simply as petrographic records of the coal beds which were encountered during the investigation. Sample sites are indicated in Figure 3.

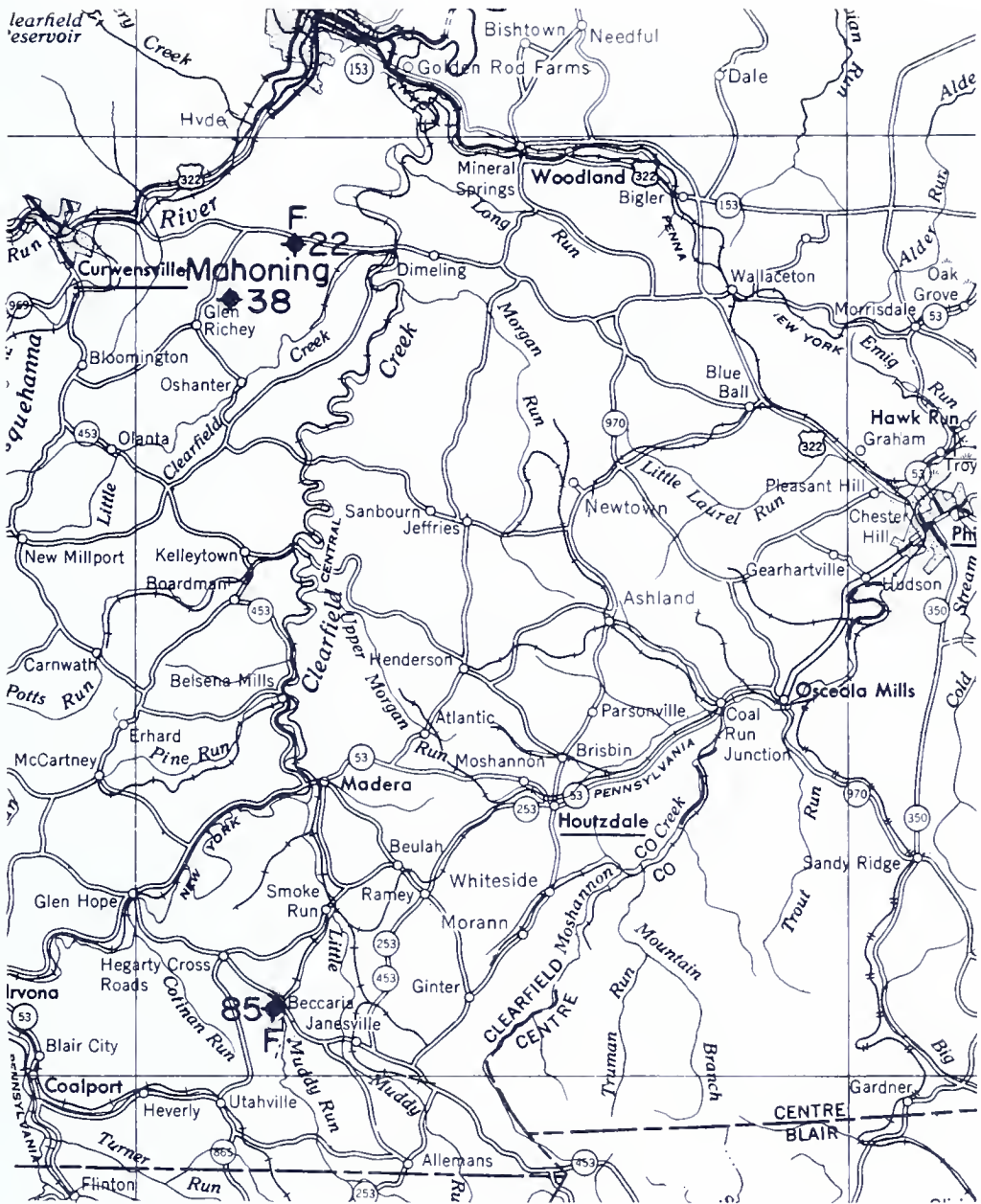


Figure 3. Location of samples collected from Conemaugh coals.

ALLEGHENY COALS

The important economic coals of the Houtzdale quadrangle are found in the strata of the Allegheny Group. The coals are treated in their stratigraphic order from the uppermost beds downward (Figure 2). Early mining in the Houtzdale area concentrated on the thicker phases of the Upper Freeport, the Lower Freeport, and the Lower Kittanning coals. As

a result, considerable portions of these beds have been mined out by underground mining methods. Only a few deep mines are still operating. Present production from these beds is from coal left near the outcrop which is amenable to modern strip mining techniques.

Upper Freeport Coal

The Upper Freeport coal (E, or Cap Seam) in the Houtzdale quadrangle is usually a single persistent bed averaging about 30 inches thick. The coal is characteristically clean and bright, having only one or two thin partings near the base. Sulfur content is generally low. In some areas the coal has been removed or reduced in thickness by erosion. In these areas a sandstone unit replaces the normal dark gray shale roof rock.

The Upper Freeport is present in the Houtzdale syncline in the southern part of the quadrangle and in the Clearfield syncline in the northwestern corner. In addition, some local uneroded patches are found on hilltops. In some areas of western Pennsylvania, the overlying Upper Freeport rider coal rests directly on the Upper Freeport seam. The two coals are together in some localities very near the southern and western edge of the quadrangle. Consequently, there is a possibility of such an occurrence locally in the Houtzdale area.

Nine samples were collected for examination from the locations shown in Figure 4. Table 1 summarizes the results of the petrographic analysis of the bed. The columns studied contained about 90 percent vitrinoids.

The total ash concentration determined for the samples varies between 5.5 and 9.6 percent, well within the range of coal usable for industrial purposes. BTU values should be extremely high relative to the other coals of the district.

Coal layers within the Upper Freeport bed have similarities which permit widespread correlations throughout. Figure 5 and Table 2 are presented to show the lateral continuity of the layers in the quadrangle. If we assume that relatively constant chemical and physical properties existed from place to place at the same time in the Upper Freeport coal-forming swamp then these data may be interpreted to suggest that the coal was deposited synchronously, except for the lowest benches.

The marked differences between the petrographic analysis of the Upper Freeport coal and those obtained from the Upper Freeport rider coal (Appendix, Samples 85-C-22 and 85) will explain why the total coal behaves in an abnormal fashion when the two beds are mined together. Often the higher coal is not recognized by the coal producer when it rests directly on the Upper Freeport bed.

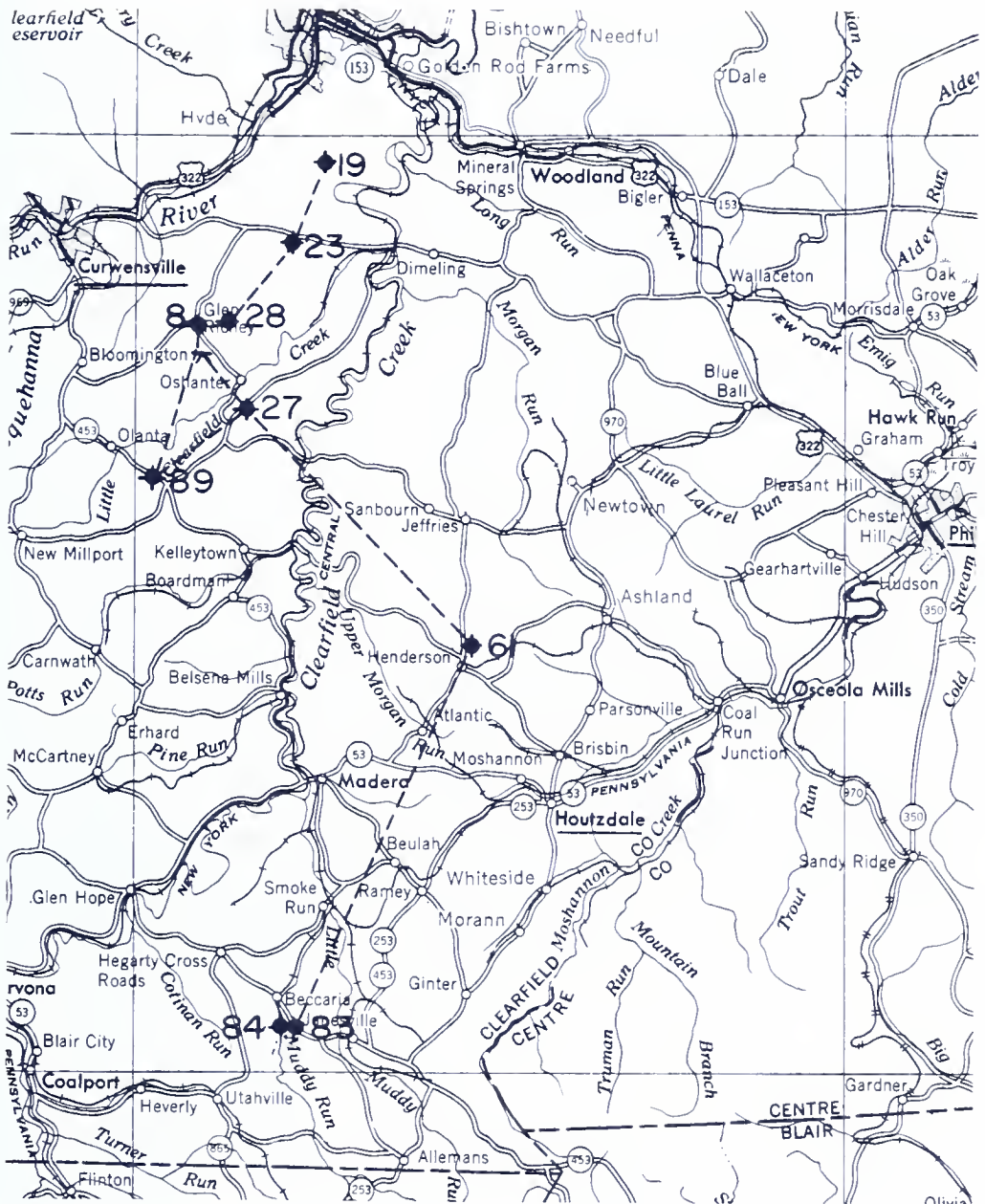


Figure 4. Location of samples collected from the Upper Freeport coal.

Lower Freeport Coal

The Lower Freeport coal (D. or Moshannon) in this quadrangle is found about 30 to 60 feet below the Upper Freeport. Although persistent throughout the quadrangle, it is quite variable both in thickness and in quality. In the southeastern quarter of the area, the coal is often more

Table 1. *Petrographic composition of the Upper Freeport coal.*

TOTAL BED

Column Sample No.	Vitrinoids	Exinoids	Micrinoids	Semi-fusinite	Fusinite	Ash
23	90.1	1.7	2.7	0.5	5.0	8.4
28	93.7	2.0	1.8	0.4	2.1	7.0
8°	94.3	0.8	2.0	0.6	2.3	8.7
19°	-	too weathered for microscopy			-	(13.0)
89	91.9	2.6	2.1	0.7	2.7	9.6
27	91.8	1.8	2.8	0.3	3.3	8.7
61	92.0	3.1	2.6	0.6	1.7	8.0
83	93.8	2.6	1.5	0.1	2.0	9.6
84	91.7	1.4	2.9	1.3	2.7	5.5
Average	92.4	2.0	2.3	0.6	2.7	8.2

° severely weathered

than 6 feet thick. Elsewhere, the coal may consist of one or more benches separated from each other by 15 to 30 feet of rock.

In the Clearfield syncline the coal is usually a single bed about 36 inches thick. Locally, a thin, dirty upper bench is encountered up to 30 feet above the persistent coal horizon.

Generally, the coal is moderately bright, and contains numerous thin knife-edge partings of fusain or clay. Also, three or more clay partings, 1 to 3 inches thick, may separate the bed into distinctive benches, thus giving the coal seam an overall stratified appearance. In some parts of

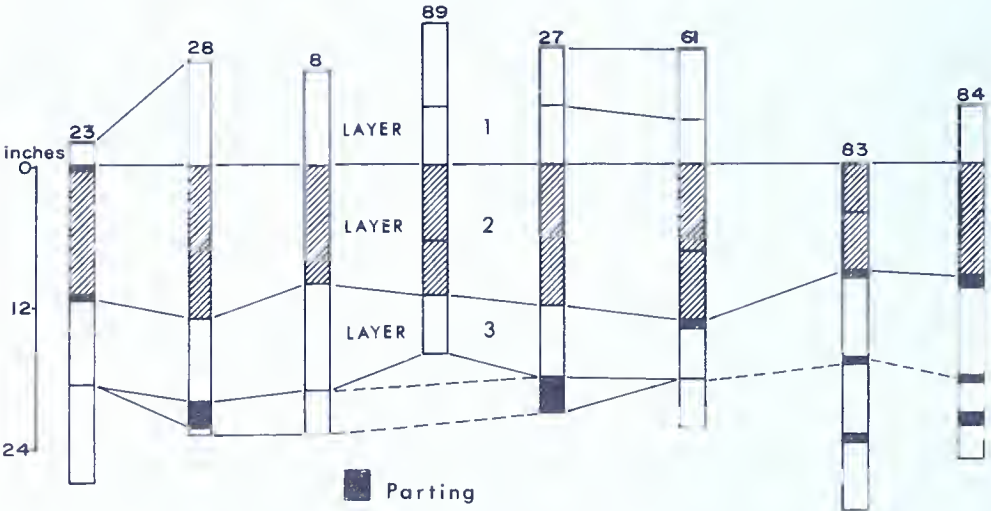


Figure 5. Correlation of the Upper Freeport coal bed by layers having similar petrographic analyses.

the Glen Richey quadrangle, a layer of canneloid coal or shale caps the bed. If the thicker partings and the canneloid layer are excluded, the coal contains a low percentage of ash. Like the Upper Freeport coal, the sulfur content is low.

Twelve samples of coal were collected from this coal zone at the locations shown in Figure 6. Table 3 presents the overall petrographic composition of the coal in the quadrangle. The spread of the data in Table 3 may indicate that, at least in part, the coal had different histories

Table 2. *Upper Freeport coal — petrographic composition by layers.*

<i>Layer 1</i>					
<i>Column</i>			<i>Percent</i>		
<i>Sample No.</i>	<i>Vitrinoids</i>	<i>Exinoids</i>	<i>Micrinoids</i>	<i>Semi-fusinite</i>	<i>Fusinite</i>
23	88.4	2.2	3.8	0.6	5.0
28	89.6	2.8	3.4	0.8	3.4
8*	92.8	1.2	2.8	-	3.2
89	89.2	4.6	2.4	0.4	3.4
27	88.4	2.9	3.1	0.6	5.0
61	89.0	5.3	3.1	1.4	1.2
84	91.4	1.8	5.0	1.0	0.8
Average	89.7	3.5	3.1	0.7	3.0
<i>Layer 2</i>					
23	91.0	2.4	2.2	1.0	3.4
28	96.4	1.6	0.8	-	1.2
8*	98.4	0.4	1.2	-	-
89	95.5	1.4	1.3	0.4	1.4
27	94.8	1.2	2.0	-	2.0
61	95.0	2.4	1.4	-	1.2
83	95.6	1.9	1.4	-	1.1
84	92.8	1.6	2.2	0.4	3.0
Average	94.9	1.6	1.6	0.2	1.7
<i>Layer 3</i>					
23	94.0	1.4	1.6	-	3.0
28	93.6	2.0	1.6	0.8	2.0
8	91.4	0.6	2.0	2.0	4.0
89	90.4	0.4	3.2	2.0	4.0
27	92.0	1.0	3.8	0.2	3.0
61	92.0	1.8	3.0	0.2	3.0
83	94.2	2.0	1.4	-	2.4
Average	92.0	1.3	2.5	1.0	3.2

* severely weathered

Table 3. *Petrographic composition of the Lower Freeport coal.*

Sample No.	Fusinoids					Thickness	
	Vitrinoids	Exinoids	Micrinoids	Semi-fusinite	Fusinite	Ash	Inches
7	87.7	1.0	5.2	1.1	5.0	9.5	38
(24)	—	weathered	—	—	—	8.8	29
25	90.5	1.8	3.6	0.7	3.4	9.5	33
29	89.0	2.0	4.9	0.6	3.5	8.0	37
39	87.8	4.1	4.6	1.5	2.0	8.8	34
53	88.6	2.8	3.5	1.9	3.2	4.2	55
58	91.9	1.6	2.8	0.4	3.3	6.1	37½
62	87.0	1.5	5.0	1.1	5.4	6.5	69
71°	89.7	4.1	2.7	1.2	2.3	10.1	28
76	88.3	2.2	4.3	1.5	3.7	8.2	75
86	91.5	1.9	2.5	0.9	3.2	6.8	26
(87)-upper split	—	—	—	—	—	(30.8)	
88	89.4	3.1	5.1	0.2	2.2	8.0	30½
90	84.2	3.4	4.3	1.3	6.8	6.9	22
Average	88.7	2.3	4.2	1.0	3.8	7.5	

* partial-(87) excluded from totals

The lower layers of the Lower Freeport coal occur only in the southeastern half of the Houtzdale quadrangle (Layer 5 to base of coal shown in Figure 7) and were formed in the Houtzdale Basin, which probably existed only in the southern half of the quadrangle. These layers are assumed to have been deposited before coal-forming conditions reached the northwest part of the area. Thus, the Lower Freeport coal in the Clearfield syncline of the Glen Richey 7½-minute quadrangle (Figure 7) is younger than the bulk of the thick Lower Freeport coal in the Ramey and Houtzdale 7½-minute quadrangles. The coal in the southern part of the Glen Richey 7½-minute quadrangle (Figure 6, #90) accumulated when coal-forming conditions ultimately submerged the topographic high which separated the Clearfield Basin coal from the basin to the southeast. There is little petrographic data to suggest that the separated upper coal bench (Figure 7, layer 2) in the Glen Richey quadrangle was connected with the uppermost persistent layers of the coal in the southeast. There is some evidence, however, (Appendix, Column 76) that the canneloid shale of the northwest is present just above layer 1 in the southeastern part of the quadrangle.

The decrease in vitrinoid content along with increases in micrinoid and fusinoid content in successively higher coal layers (Shown in Table 4) are typical of the normal sequence of coal deposition in the Houtzdale quadrangle. Layers 3 and 4 have almost identical average petrographic analyses and could well be combined were it not for the extremely persistent parting which separates them in the Clearfield syncline.

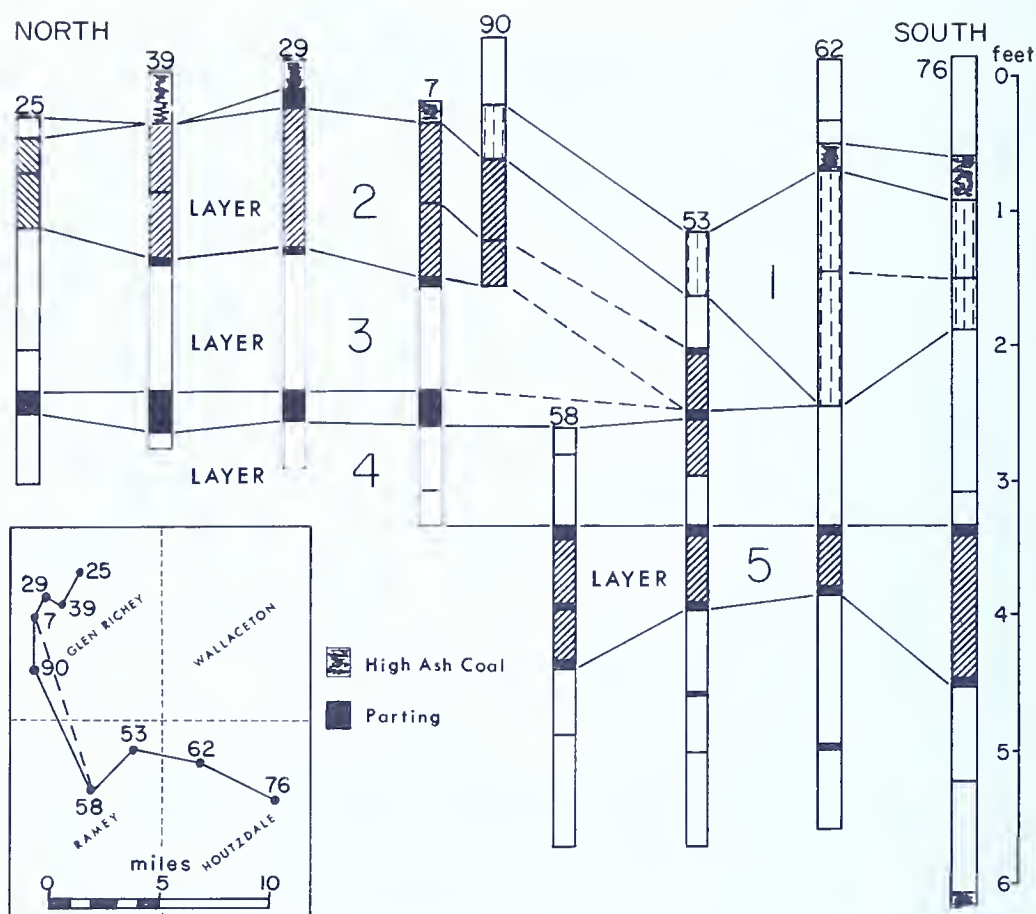


Figure 7. Correlation of the Lower Freeport coal by layers having similar petrographic analyses.

Upper Kittanning Coal

The Upper Kittanning (C') coal is present generally between 50 and 90 feet below the Lower Freeport coal. It is not a persistent coal in much of the quadrangle. Where found, it varies greatly in thickness, number of beds, and quality. This locally important coal usually is found as one of the rock types filling a pre-Upper Kittanning stream channel which had been deeply eroded into underlying strata (Figure 2). The channel fill may include as many as five coal beds separated by clays, mudstones, and siltstones. The thickness ranges from mere streaks of coaly shale to coal beds more than 6 feet thick. The coal either is missing, or is a relatively thin single bed when not related to a channel.

The basal bed of coal (not sampled) near Mineral Springs is more than 5 feet thick in the center of the ancient channel. Another bed at that site is about 2 feet thick (Sample 85-C-20). A few hundred feet away, both coals are missing.

Table 4. *Lower Freeport coal — summary of average maceral composition by layers.*

Bed Layer	Vitrinoids	Exinoids	Micrinoids	Fusinoids
1	76.7	2.4	8.0	12.9
2	86.3	2.4	5.1	6.2
3	89.9	1.8	3.5	4.8
4	90.0	1.3	4.3	4.4
5	93.7	1.9	1.3	3.1

(1) includes semi-fusinite

Similar channel deposits of thick Upper Kittanning coal less than 800 feet wide found at several places in western Pennsylvania (Figure 8) are grouped into a linear pattern suggesting that a major pre-Upper Kittanning river channel system (or systems) may have crossed the Allegheny Plateau in an east-west direction. The Upper Kittanning cannal coal deposits west of the study area have been interpreted as peat accumulations in oxbows of major river systems (Ashley, 1918; Fettke, 1923).

Only the uppermost layer tends to be canneloid in the coals of the Houtzdale quadrangle. Table 5 summarizes the data from places indicated in Figure 9. Because of the sporadic distribution and local nature of the deposits, no attempt was made to correlate the petrography in the quadrangle. Although the coal most often has a high ash content, the sulfur concentration is usually low.

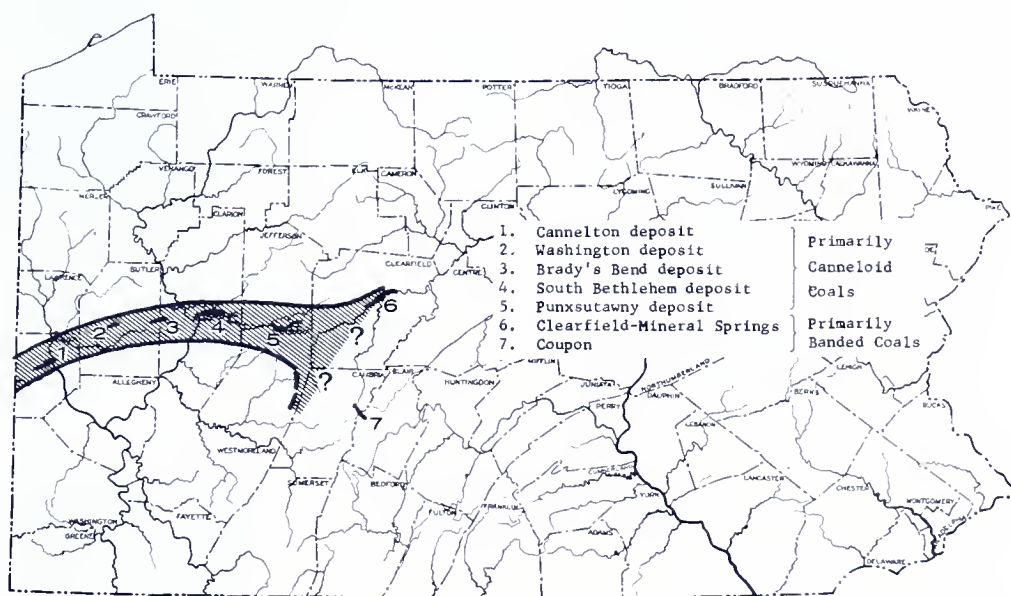


Figure 8. Major pre-Upper Kittanning drainage system in western Pennsylvania.

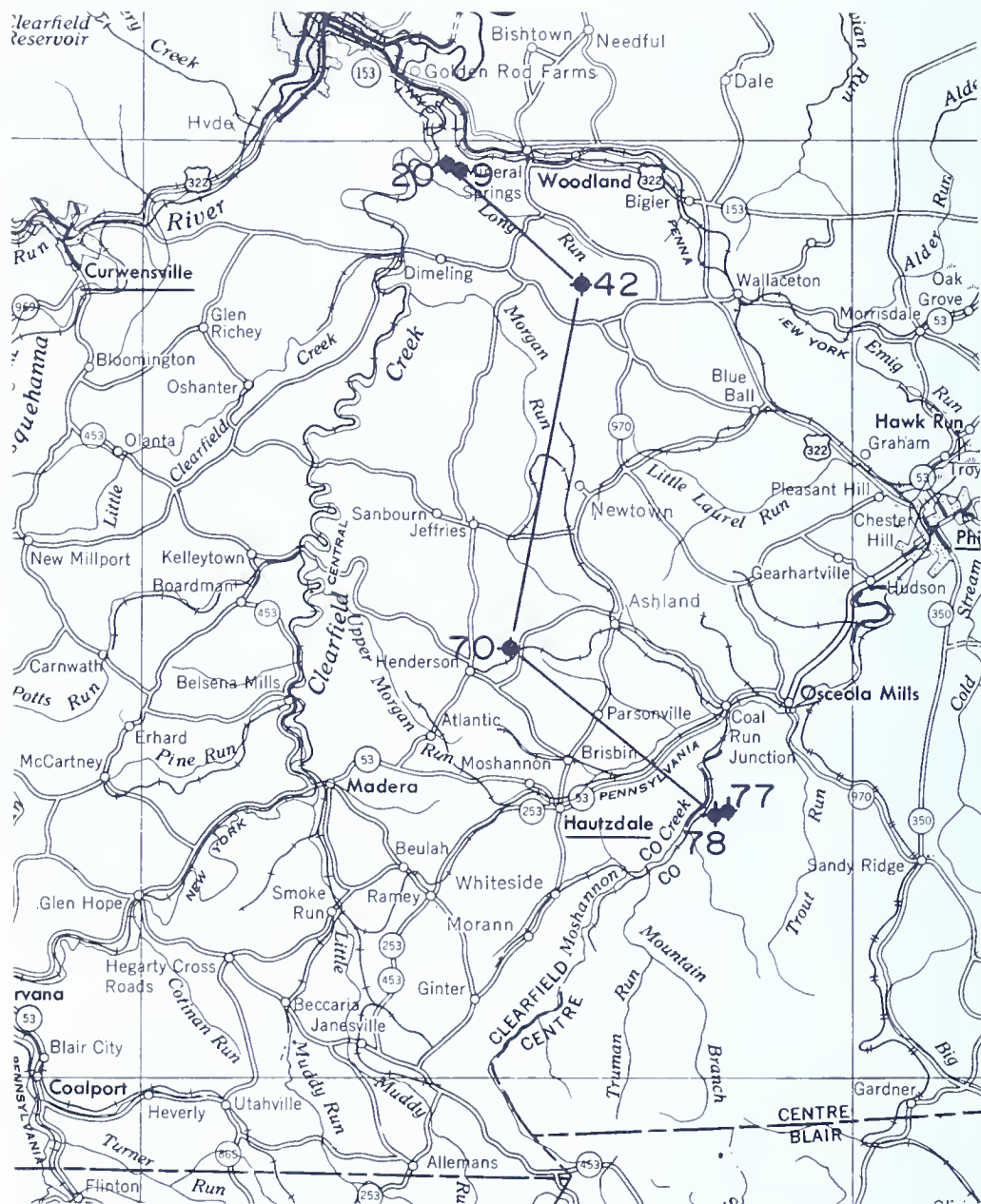


Figure 9. Location of samples collected from the Upper Kittanning coal.

Middle Kittanning Coal

The Middle Kittanning (C) coal is found between 130 and 160 feet below the Upper Freeport coal horizon and 45 to 60 feet above the main-mined beds of the Lower Kittanning coal (Figure 2). Like the other coals of the Houtzdale area, at many localities it has more than a single bed. In the central part of the quadrangle particularly, and to the southeast,

Table 5. *Petrographic composition of the Upper Kittanning coal.*

Column Sample No.	Vitrinoids	Exinoids	Micrinoids	Semi-fusinite	Fusinite	Ash
9	87.5	0.9	4.2	1.7	5.7	19.9
20	85.8	2.6	3.4	1.9	6.3	16.2
42	84.8	3.1	3.0	1.2	7.9	12.9
70	75.0	5.3	4.0	1.0	14.7	7.6
77x	91.5	4.3	2.4	0.5	1.3	9.5
78xx	76.6	5.0	4.1	1.7	12.6	6.3
Average	83.6	3.5	3.5	1.3	8.1	12.1
x upper bed						
xx lower bed						

the seam tends to split and may be present as a double- or triple-bedded coal. The Middle Kittanning seam is extremely persistent and is usually more than 2 feet thick. Often there is a single high ash layer in the center of the coal, as shown in Sample 85-C-63. Other clayey partings are more local in nature. There is a tendency for the Middle Kittanning coal to have a moderately high percentage of sulfur which may be related to pyrite-rich marine sediments overlying the coal. However, it is a good steam coal when the sulfur and ash content is reduced.

The Middle Kittanning coal has recently become more important to miners because of the decrease of readily available reserves of thicker Freeport and Lower Kittanning coals.

Figure 10 shows locations of the samples reported below. The total composition of the Middle Kittanning coal at these sites is recorded in Table 6. An average vitrinoid content near 90 percent with only 6.5 percent average total inerts indicates that this coal compares favorably with the best coals of the Houtzdale area if mineral matter and pyrite concentrations are not considered.

Abnormally thick coal was collected at the Wilks Mine (Sample 85-C-37). The increase is due to presence of benches below the 27-inch level. The presence of these additional coal layers suggests that a restricted local swamp deposit developed in this vicinity prior to the covering of the quadrangle by the coal swamp in which the remaining Middle Kittanning formed. The coal layer above the 27-inch level is typical of the lowermost bed in the Middle Kittanning sequence (Figure 11).

Lower Kittanning Coal

The Lower Kittanning ("B" or Miller) is probably the most important coal in the Allegheny Group. It is almost everywhere a thick, minable coal. The coal is found between 165 and 220 feet below the Upper Freeport coal, but usually at about 200 feet in the Houtzdale quadrangle.

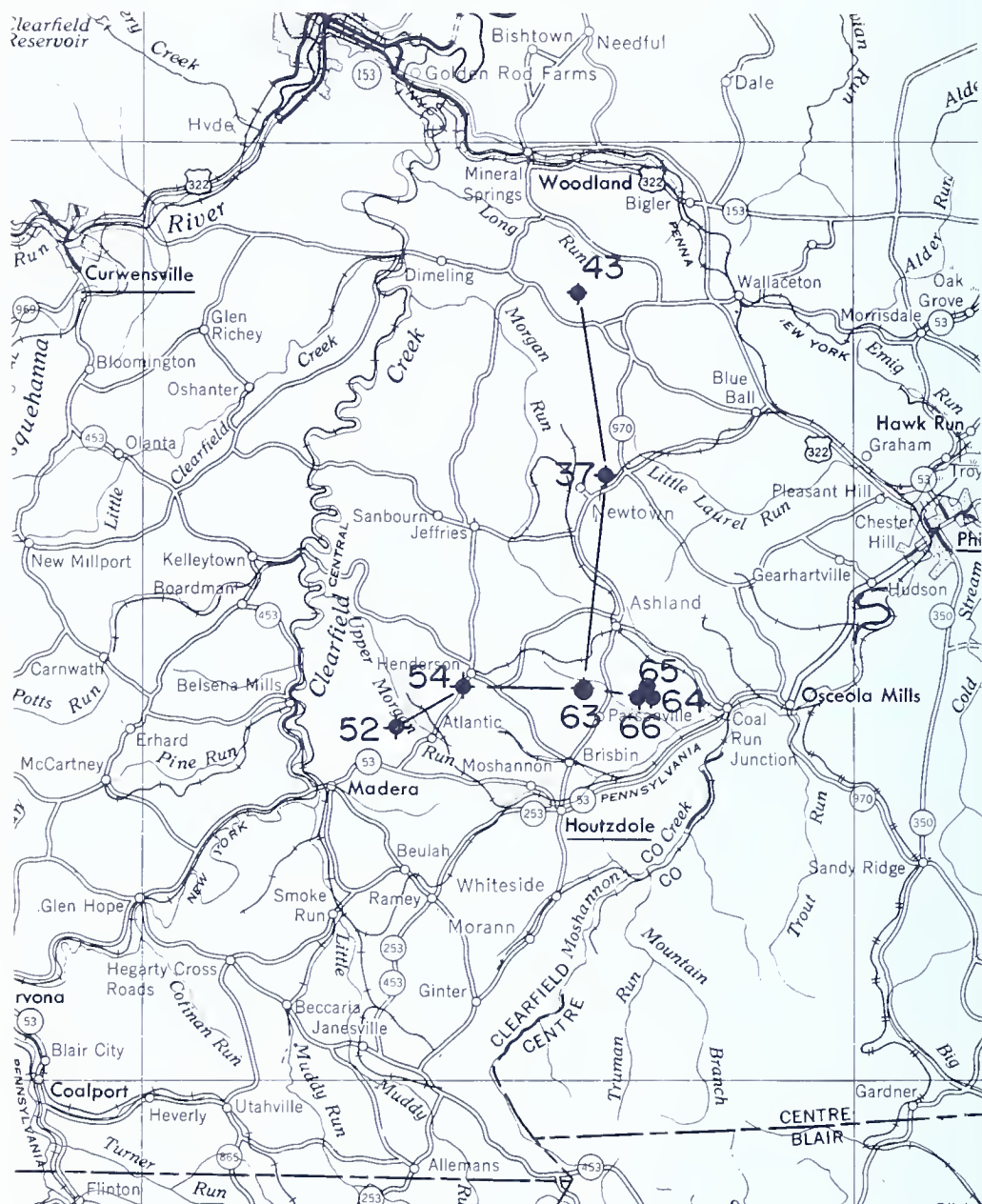


Figure 10. Location of samples collected from the Middle Kittanning coal.

The coal consists of several beds in this area, unlike its occurrence as a single bed farther west in Pennsylvania. Figure 12 illustrates the number of coal beds included in the interval of the Lower Kittanning Formation in the Houtzdale quadrangle. For ease of understanding, the beds are numbered. At this time it is not definitely known which of the beds becomes the persistent single-bedded coal elsewhere in Pennsylvania.

Table 6. *Petrographic composition of the Middle Kittanning coal.*

Sample No.	Vitrinoids	Exinoids	Micrinoids	Fusinoids		Ash	Thickness
				Semi-fusinite	Fusinite		Inches
37	94.5	1.7	1.6	0.1	2.1	7.9	58
43	84.6	4.3	5.5	1.8	3.8	10.1	26½
52	90.1	2.8	2.7	0.9	3.5	6.5	23
54	87.8	2.8	3.6	1.3	4.5	6.6	27½
63	90.4	3.5	2.0	0.9	3.2	11.6	39
64	90.4	3.8	2.0	1.2	2.6	8.7	30
65	87.8	4.3	5.2	0.7	2.0	10.8	22
66	89.8	5.4	3.7	0.2	0.9	6.3	18½
Average	89.4	3.6	3.3	0.9	2.8	8.6	

Beds B-2 and B-3 represent the main-mined portion of the coal and are "the" Lower Kittanning Coal of earlier writers. All of the remaining beds are strip mined locally, but usually only during recovery of beds B-2 and B-3. The main-mined coal is more than 40 inches thick excluding the 6- to 9-inch parting separating beds B-2 and B-3. Table 7 summarizes the average composition recorded for the beds numbered in Figure 12. Sites of samples reported in Table 8 are shown in Figure 13.

The bottom bed (B-1) is found only in local discontinuous deposits, suggesting that these deposits were formed in the troughs that filled with peat before the advance of the widespread swamp conditions which formed the later extensive beds of the area. Because of the local podlike distribution of B-1, the character and quality is quite variable (Table 8). Generally B-1 has a fairly low percentage of sulfur, but contains a high percentage of other mineral matter. It is often left undeveloped during mining.

The overlying widespread bed (B-2), is very closely related to B-1 petrographically. The two can be distinguished only by a comparison of the exinoid value (Table 7). B-1 tends to contain about half as much exinoid as micrinoid. B-2 on the other hand, generally has more nearly equal proportions of these components. B-2 has a high percentage of sulfur and mineral matter. When mined and combined with the immediately overlying B-3 bed, these high percentages are reduced permitting more widespread value from bed B-2 than it would have were it not associated with B-3.

Coal layer B-3 has the lowest percentage of ash and sulfur of the Lower Kittanning complex. The thickness of B-3 varies greatly throughout the quadrangle (Table 8). To the northeast, a secondary bed (B3b) splits from the top of B-3. This local split sometimes is thick enough to be recovered. Petrographically it is unlike the beds above or below and when present serves as a distinctive marker.

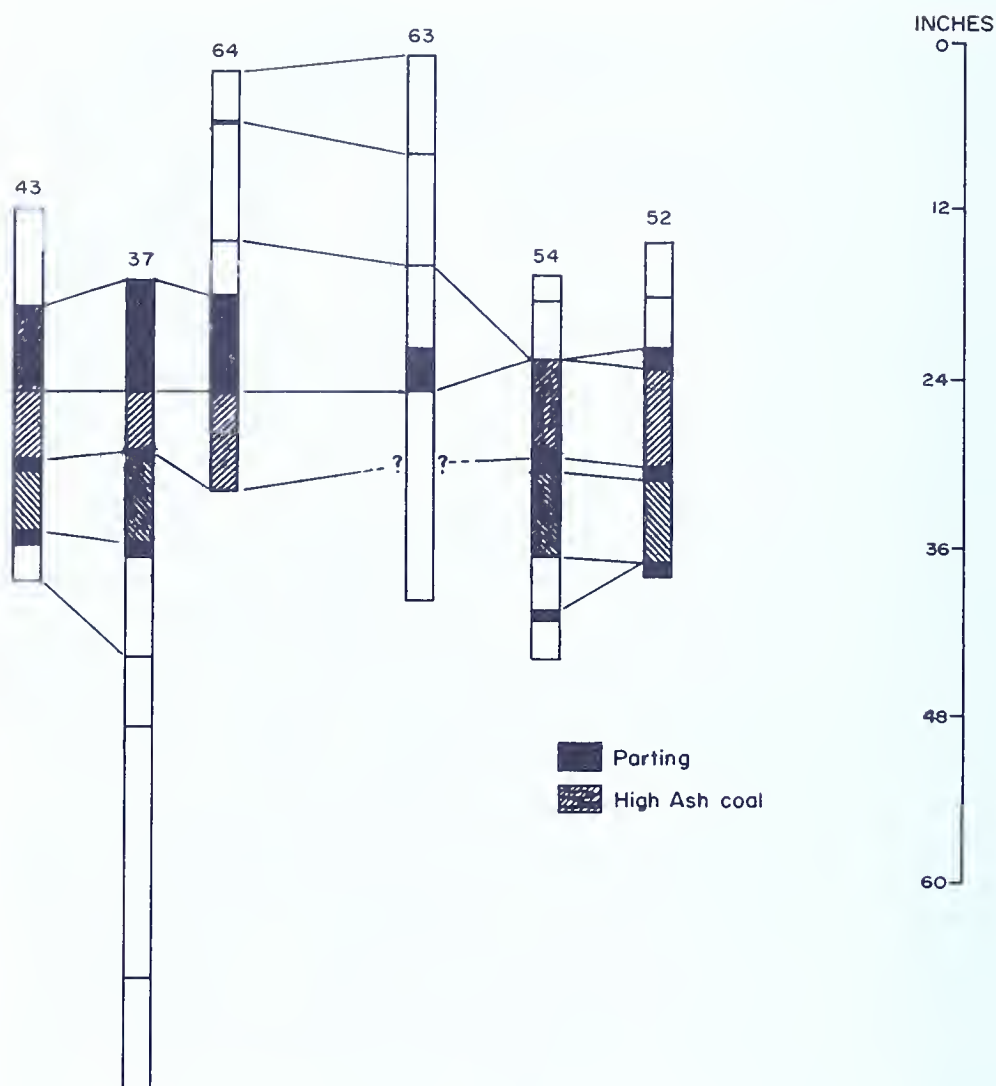


Figure 11. Correlation of the Middle Kittanning coal by layers having similar petrographic analyses.

The coal layer B-4, sometimes called the Lower Kittanning rider coal, is almost 20 feet above B-3a. The bed is persistent, seldom more than a foot thick, but has a remarkably low percentage of ash throughout. It has an analysis reminiscent of bed B-3a. When sufficiently thick, it is recovered.

The top unit (B-5) is discontinuous, has a high percentage of ash and is seldom recovered. Very often the horizon has been removed by erosion. The petrographic data on B-5 are presented for completeness of all coals found in the Lower Kittanning coal complex of the Houtzdale quadrangle.

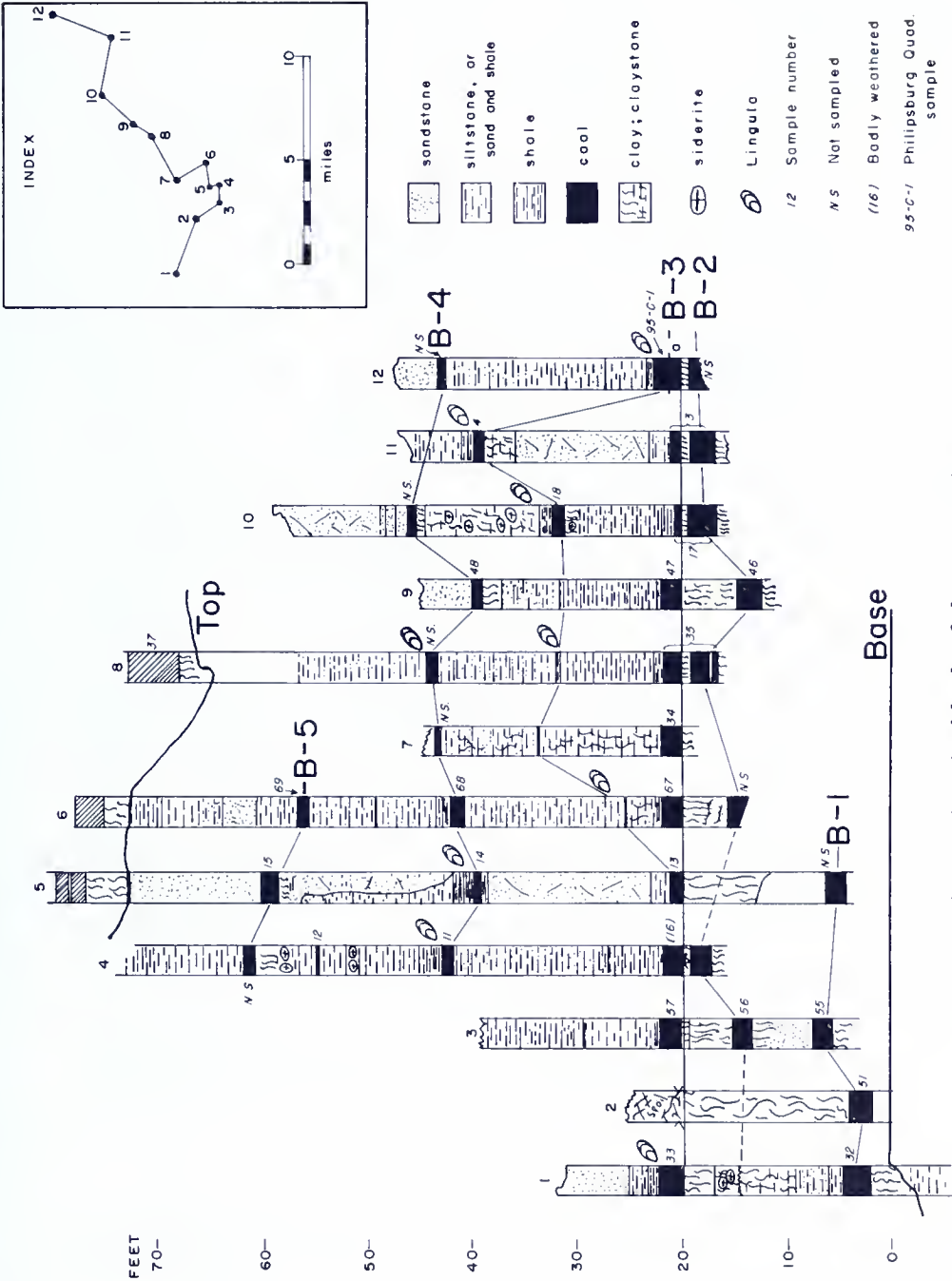


Figure 12. Coal beds of the Lower Kittanning Formation.

Table 7. *Average petrographic composition of the Lower Kittanning coal complex.*

Bed No.	Vitrinoids	Exinoids	Micrinoids	Fusinoids		Ash	Number of Samples
				Semi-fusinite	Fusinite		
5	87.1	2.3	3.0	1.8	5.8	14.1	3
4	93.2	3.5	2.2	0.3	0.8	6.6	6
3b	86.2	5.7	4.7	0.7	2.7	8.0	8
3a	92.2	3.1	2.4	0.6	1.7	6.5	17
2	84.7	4.2	4.9	1.4	4.8	12.3	5
1	86.5	2.4	4.6	1.6	4.9	9.2	4

together. There they have an aggregate thickness of about 6 feet. The top coal, however, is seldom usable because of a high percentage of ash. To the north, the three coals are separated by twelve or more feet. Locally, the bottom coal is missing.

During the course of this study, no workable Clarion 3 coal was found. The horizon is very persistent over much of the area only as a coaly shale unit about a foot thick. Clarion 2 tends to be thicker than the underlying Clarion 1 and contains more sulfur than the lower bed. In addition, Clarion 2 often is cannelloid at the top of the bed which gives the coal layer a blocky appearance. These characteristics aid in the identification of the coals in the field.

Table 9 contains a summary of the petrographic composition of the Clarion coals collected at sites shown in Figure 14. Comparison of the average values shows that Clarion 1 has more vitrinoids than Clarion 2 in this quadrangle.

POTTSVILLE COALS

Only one coal (Mercer) is exposed at the top of the Pottsville strata which underlie the valuable coals of the Allegheny Group. In the Houtzdale quadrangle, Pottsville coals are not economically important, but do serve as markers for establishing correlations for the economic clay horizons found both at the base of the Allegheny sequences and just beneath the Mercer coal horizon.

Although sought during the field work, the Quakertown coal was not found for sampling. The Quakertown horizon is normally about 100 feet below the Mercer coal.

Mercer Coal

Mercer coals are usually exposed only as a result of strip or underground mining operations for the valuable clay deposits lying beneath the lowest coal bed of the Houtzdale quadrangle. The Mercer horizon is found from 100 to 150 feet below the Lower Kittanning coal (B-2).

Table 8. Petrographic composition of beds in the Lower Kittanning coal complex.

A. Bed B-5	Sample No.	Vitrinoids	Exinoids	Micrinoids	Semi-fusinite	Fusinite	Ash	Thickness Inches
	15	84.2	3.1	3.1	2.0	7.6	12.3	20
	69	90.2	1.3	2.8	2.3	3.4	12.5	14
	74	87.0	2.4	3.1	1.0	6.5	17.5	9
	Average	87.1	2.3	3.0	1.8	5.8	14.1	
B. Bed B-4	11	92.7	2.7	3.5	0.4	0.7	9.5	12½
	14	90.5	3.6	3.9	0.9	1.1	11.4	11
	48	93.9	4.6	1.1	—	0.4	3.5	9
	59	95.4	2.0	1.5	0.1	1.0	6.9	11
	68	92.8	4.0	1.4	0.3	1.5	3.1	11½
	73	94.2	4.0	1.5	0.1	0.2	5.4	12½
	Average	93.2	3.5	2.2	0.3	0.8	6.6	
C. Bed B-3b	4	88.0	5.8	5.0	0.2	1.0	16.5	9
	13	88.8	4.2	5.5	0.5	1.0	6.0	17
	18	83.0	5.4	7.0	0.6	4.0	6.6	14
	40#	87.9	5.1	3.0	1.6	2.4	8.6	22
	81#	81.6	8.6	4.6	—	5.2	8.4	4
	75#	84.2	8.8	4.8	0.6	1.6	13.8	6
	82	87.9	4.0	3.7	0.7	3.7	4.6	14
	95-C-1b	88.5	3.9	3.8	1.4	2.4	5.2	13
	Average	86.2	5.7	4.7	0.7	2.7	8.0	
D. Bed B-3a	2	92.0	3.0	2.6	0.6	1.8	3.5	12
	3a	92.0	4.4	2.0	—	1.6	4.4	9
	17a	92.6	4.2	2.5	—	0.7	10.0	6
	33	93.0	2.4	2.5	—	2.1	8.8	16
	34	94.4	1.9	2.3	0.7	0.7	5.8	20

Table 8. (Continued)

Sample No.	Vitrinoids	Exinoids	Micrinoids	Semi-fusinite	Fusinite	Ash	Thickness Inches
35a	91.5	2.8	3.0	1.3	1.4	6.6	21½
40#	91.2	3.6	3.2	0.4	1.6	8.2	6
45	91.3	3.3	2.6	0.3	2.5	3.8	20
47	92.5	3.5	2.0	0.9	1.1	5.9	17½
57	91.9	3.3	2.6	0.9	1.3	6.5	21½
60	91.1	3.2	2.3	0.8	2.6	6.6	23½
67	93.1	3.2	2.3	0.3	1.1	4.5	22
72	91.0	3.7	2.1	1.2	2.0	5.6	23
75#	92.0	2.4	2.2	1.2	2.2	6.3	26½
81#	91.7	3.0	2.0	0.1	3.2	7.4	14
91	94.0	2.2	2.5	0.3	1.0	7.5	22
95-C-1a	92.8	2.7	1.9	0.8	1.8	9.2	12½
Average	92.2	3.1	2.4	0.6	1.7	6.5	
E. Bed B-2							
3b	86.5	4.3	4.7	0.9	3.6	9.1	30½
17b	83.9	4.5	4.9	1.4	5.3	12.0	27½
35b	80.5	4.7	6.1	1.7	7.0	16.0	22½
46	87.6	3.7	3.7	1.6	3.4	12.8	26
56	85.3	3.7	4.9	1.2	4.9	11.5	17½
Average	84.7	4.2	4.9	1.4	4.8	12.3	
F. Bed B-1							
32	87.4	1.9	4.9	0.9	4.9	8.6	21
51	83.8	2.9	5.4	1.9	6.0	12.1	25
55	87.8	2.5	3.7	2.2	3.8	6.1	21
80	87.2	2.4	4.2	1.4	4.8	10.0	48½
Average	86.5	2.4	4.6	1.6	4.9	9.2	
# partial							

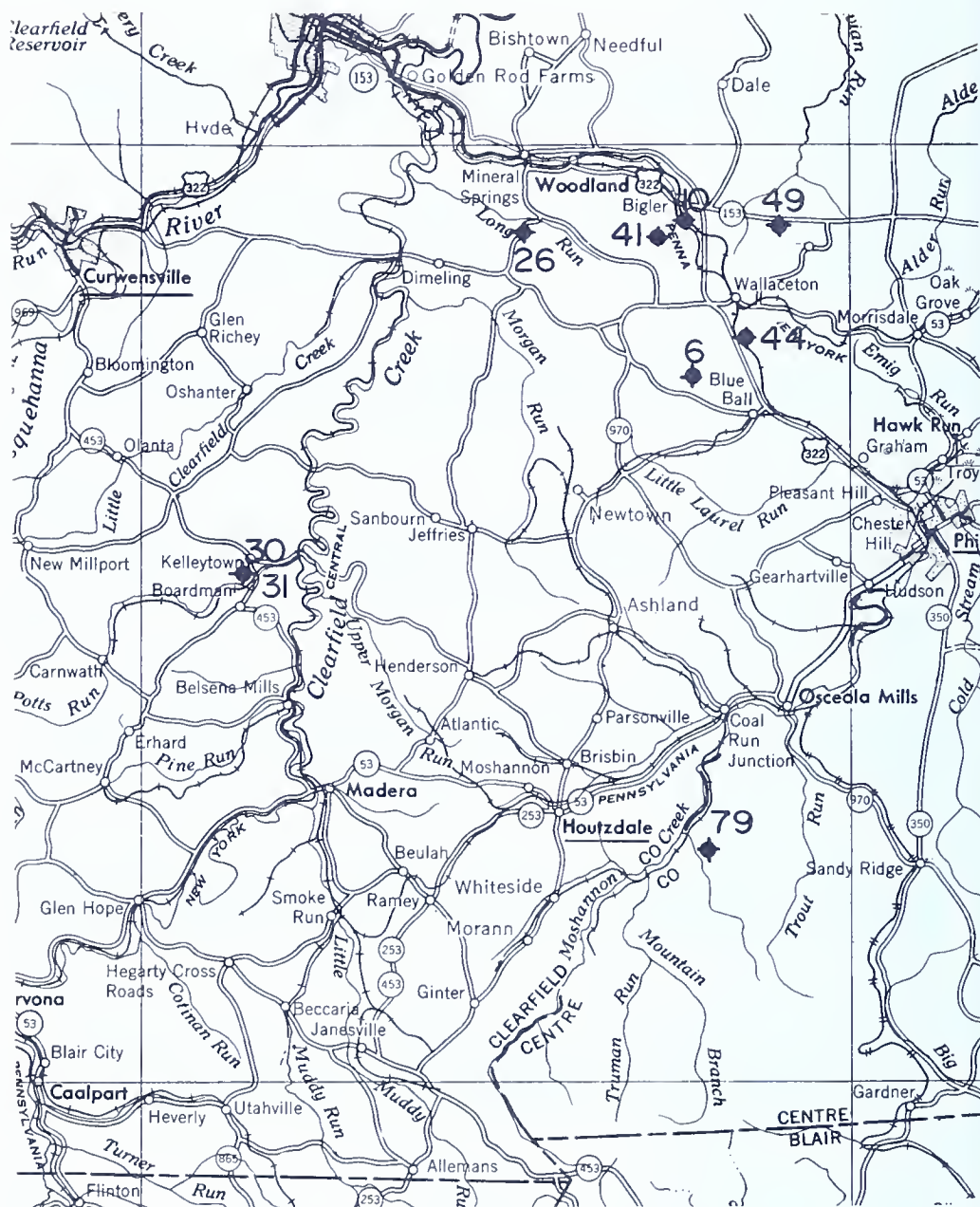


Figure 14. Location of samples collected from the Clarion coals.

The coal was deposited upon an uneven erosion surface, giving rise to the multiple-bedded deposits characteristic of most coals in the Houtzdale quadrangle. Where the interval between the Lower Kittanning and the Mercer is reduced, the Clarion coals may lie 6 to 8 feet above the upper Mercer, separated by a plastic or semi-plastic clay zone (Figure 2).

The coal is usually high in ash and sulfur content, thin, and rarely minable. For this reason, only three samples were collected at the sites

Table 9. *Petrographic composition of the Clarion coals.*

Sample No.	Vitrinoids	Exinoids	Micrinoids	Fusinoids		Ash	Bed Thickness
				Semi-fusinite	Fusinite		
Clarion 3							
6	—	—	dark shale and coaly shale		—	—	11"
31	—	—	shaly coal		—	39.7	9
79	—	—	coaly shale		—	—	11
Clarion 2							
6	84.8	6.0	4.0	—	5.2	9.3	18
26	85.8	4.0	6.2	0.3	3.7	14.0	26
30	81.7	5.1	6.9	1.8	4.5	13.5	25
79#	81.0	4.1	6.4	1.8	6.7	8.2	32
Average	83.3	4.8	5.9	1.0	5.0	9.0	
Clarion 1							
10	84.4	3.3	5.3	1.3	5.7	5.9	20
41	89.2	3.5	2.0	0.5	4.8	5.1	24
44	88.8	3.3	3.6	1.1	3.2	6.5	12
49	84.1	2.3	4.7	2.2	6.7	6.9	16
79#	90.4	2.0	3.9	0.7	3.0	11.2	29
Average	87.4	2.9	3.9	1.1	4.7	7.1	
Undifferentiated							
79	85.5	3.1	5.2	1.3	4.9	9.7	63½*

partial values * excludes coaly shale of Clarion 3

shown in Figure 15. Table 10 summarizes the petrographic data obtained from these coals. The lower coal contains dull canneloid bands. Numerous megaspores are present in the canneloid shale partings, but in the adjacent coal layers the lack of exinoid concentrations as high as might be anticipated from megascopic observations suggests that these megaspores were highly carbonified.

CHEMICAL CHARACTERISTICS

Proximate and ultimate analyses of mine samples collected by previous writers from the approximate locations shown in Figure 16 are presented in Table 11. These samples represent the coal in place at specified locations within the mine. They are collected in accordance with the standard methods employed by the U.S. Bureau of Mines and the U.S. Geological Survey (Holmes, 1918). As shown in Table 11, the coals are primarily of medium volatile rank, although a few total coal analyses do indicate low-volatile coal.

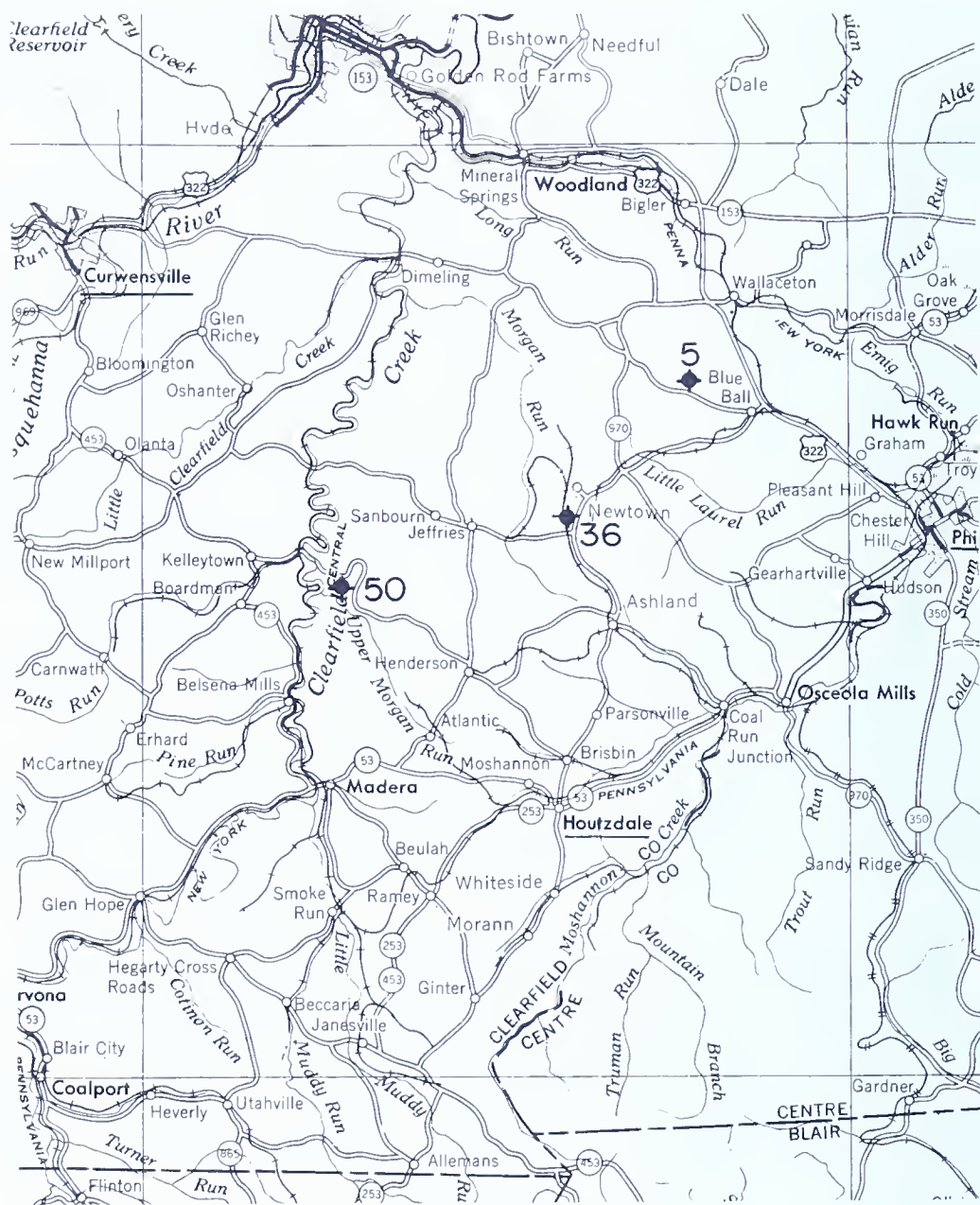


Figure 15. Location of samples collected from the Mercer coals.

The samples are listed in stratigraphic order. Some of the analyses are based upon coals which possibly have been incorrectly identified, especially some of the Lower Kittanning samples. The coal mined around Boardman has long been known to be the Clarion (Brookville) coal, but has been called the "Boardman B". The Potts Run No. 3 Mine, listed as mining Lower Kittanning coal by the U.S. Bureau of Mines (#24 in Figure 16 and in Table 11), is definitely Clarion (Shepps, personal communica-

Table 10. *Petrographic composition of the Mercer coals.*

<i>Bed</i>	<i>Sample No.</i>	<i>Vitrinoids</i>	<i>Exinoids</i>	<i>Micrinoids</i>	<i>Semi-fusinite</i>	<i>Fusinite</i>	<i>Ash</i>
upper	5	76.1	2.9	10.0	3.0	8.0	11.0
lower	36	80.3	2.7	5.1	4.8	7.1	16.5
lower	50	79.5	4.3	8.8	2.6	4.8	11.0
	Average	78.6	3.3	8.0	3.5	6.6	12.8

tion). The writer is not certain to what extent coals from other mines are miscorrelated. Consequently, original identifications of coal used in the earlier reports are preserved in the tables.

Table 12 reports proximate analyses and supplementary data for tippie and delivered samples made by the U.S. Bureau of Mines. These samples indicate quality of the coal produced at the time the coal was sampled, and may contain coal taken from several places within the named mine. These data may be used to supplement the data given in Table 11 and to ascertain the range in quality of coal actually produced in the district.

For further details on sampling and testing methods, the reader is referred to "ASTM Standards on Coal and Coke," published by the American Society for Testing Materials (1959). For additional data on chemical and physical properties of the coals of the area, earlier published reports of the U.S. Bureau of Mines on preparation characteristics (Crentz and others, 1952) and on carbonizing properties (Birge and others, 1963) may be consulted.

CONCLUSIONS

A summary of the petrographic composition of the coals studied in the Houtzdale quadrangle is presented as Table 13. This table shows that most minable coals of the quadrangle contain more than 85 percent vitrinoids, 0.8 to 5.8 percent fusinite and 0.36 to 1.8 percent semi-fusinite, and moderate to low ash percentages. The averages of generally unminable coal beds lack these characteristics. The Upper Kittanning coal is only locally minable for special reasons as mentioned earlier in the detailed treatment.

Only three Allegheny coals studied average less than 85 percent vitrinoids. These are; 1) the Upper Kittanning coal, 2) bed B-2 of the Lower Kittanning, and 3) the Clarion 2 bed. The latter two beds are persistent. When recovered, they are mined along with other coal having higher than 85 percent vitrinoid and the blending of the two coals raises the total vitrinoid values to 85 percent or more. Although the Upper Kittanning sometimes is mined and blended with the underlying Middle

significance in this area, because low vitrinoid percentages and high ash and fusinoid content make the coal poor for most uses.

The petrography of a given seam may be uniform as shown by the data on the Upper Freeport coal, or it may be extremely variable such as shown for the Lower Kittanning coal. When beds or benches of a particular coal are added or lost, the overall petrography and the chemical properties reflect that change. Composite analyses of a particular coal thus do not show the lateral continuity of layers which have similar petrographic compositions. When the more stratigraphically complex coals such as Lower Kittanning are studied layer by layer, the lateral variability in petrography determine the lack of uniform chemical properties.

Individual coal layers were shown to have laterally consistent properties in the foregoing presentation. In the opinion of the writer, this consistency represents the sum of environmental factors operative during the time of deposition of the organic matter making up the bench, as modified by regional metamorphism since the accumulation of the coal. For example, one bench may be deposited during a period characterized by extremely wet conditions; another bench during a drier period. Wetter conditions are conducive to preserving plant tissues chemically different from those preserved under long term drier conditions. Widespread stability in petrography of these benches may also indicate that different types of the coal-forming plants were more prevalent as a result of wetter or drier conditions and the different types are subsequently preferentially preserved in distinctive benches.

Lateral discontinuity and absence of bottom benches or beds of the coal is interpreted to indicate local topographic relief on the surface upon which the coal was deposited (Koppe 1963). The petrographic character of the Upper Freeport coal indicated that it was apparently only slightly affected by the local topography. The discontinuous lower layers of the Lower Freeport coal, on the other hand, indicates that the pre-coal topography may have controlled location of deposition of the lower layers (Figure 7). Local swamp development (e.g. Sample 85-C-37 discussed in the section on the Middle Kittanning coal) prior to covering of the area by the major coal swamp may add benches at the base of the coal thus changing the total petrography and chemical properties of the seam.

Sufficient petrographic differences were reported between coals of this quadrangle to permit rather close correlations and to determine the affinities to the major coals of apparent "local" or "stray" coals often found in the geological log of the strata.

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples

Location of mine sample (see Fig. 16)	Coal	Location	Mine	Location in Mine	Sample Condition	Laboratory Number	PROXIMATE PERCENT						ULTIMATE PERCENT					Reference Sources
							Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Air-dry Loss	B.T.U.	
1	Upper Freeport	3 miles west of Clearfield	Schickling	Face of main heading	1	75,672	2.8	24.9	65.8	6.7	0.7					1.6	14,140	T.P. 590, p. 174
				entry	2			25.6	67.5	6.9	0.8						14,530	
2	Upper Freeport	2½ miles northwest of Philipsburg	Conquest	Face of main entry	1	75,733	4.2	23.9	63.4	8.5	1.0					3.2	13,670	T.P. 590, p. 180
					2			25.0	66.1	8.9	1.0						14,270	
	Upper Freeport	1 mile southwest of Brinsbin	Lenore	Face of left heading, main heading	1	12,046	3.0	21.6	67.8	7.8	0.8					1.9	14,020	M6, Pt. 4, p. 65
			No. 1 & 2	No. 1 Drift														
	Freeport	1 mile southwest of Brinsbin	Lenore	Face of 2 left heading, No. 2 Drift	1	12,044	3.1	21.8	66.1	9.0	1.1					2.0	13,840	M6, Pt. 4, p. 65
3	Upper Freeport	1 mile southwest of Brinsbin	Lenore	Composite of 12,044 & 12,046	1	12,047	3.1	21.5	67.2	8.2	0.9	4.8	78.5	1.2	8.4	2.0	13,960	M8, Pt. 4, p. 65
					2			22.2	69.3	8.5	1.0	4.6	81.0	1.3	3.8		14,410	
					3			24.2	75.8		1.1	5.0	88.5	1.4	4.0		15,740	
4	Upper Freeport	1 mile southwest of Brinsbin	Lenore	Face 2 left heading	1	12,045	2.8	21.8	67.9	7.5	0.9	4.9	79.7	1.3	5.7	1.9	14,190	M6, Pt. 4, p. 65
			No. 2	No. 2 Drift	2			22.4	69.9	7.7	0.9	4.7	82.0	1.4	3.3		14,600	
					3			24.3	75.7		1.0	5.1	88.9	1.5	3.5		15,820	
	Lower Freeport		Camwath	7 room	1	20,342	3.0	24.3	85.0	7.7	1.8					2.4	13,990	T.P. 590, p. 174
			No. 1	3 right entry														
	Lower Freeport		Camwath	2 left entry,	1	20,343	3.3	23.9	66.7	6.1	1.4					2.5	14,140	T.P. 590, p. 174
			No. 1	1 left entry														
5	Lower Freeport		Camwath	Composite of 20,342 & 20,343	1	20,346	3.1	24.5	65.8	8.8	1.5	5.0	79.7	1.4	5.8	2.5	14,080	T.P. 590, p. 174
			No. 1		2			25.3	67.7	7.0	1.5	4.8	82.2	1.5	3.0		14,540	
					3			27.2	72.8		1.6	5.1	88.4	1.6	3.3		15,630	
6	Lower Freeport	2½ miles southwest of Clearfield	Eagle	1 right heading,	1	75,742	3.2	22.4	66.5	7.9	2.5					2.4	13,780	T.P. 590, p. 174
				2 right heading	2			23.1	68.7	8.2	2.5						14,250	
	Lower Freeport	3 miles west of Clearfield	Cassidy	Face of main heading	1	75,620	2.7	22.7	69.0	5.6	0.8					1.9	14,340	T.P. 590, p. 174
			No. 1															
	Lower Freeport	3 miles west of Clearfield	Cassidy	Face of 1 left heading	1	75,621	2.4	23.7	68.8	5.1	1.0					1.8	14,490	T.P. 590, p. 174
7	Lower Freeport	3 miles west of Clearfield	Cassidy	Composite of 75,620 & 75,621	1	75,622	2.8	23.0	69.0	5.4	1.0	4.9	81.5	1.5	5.7	1.8	14,450	T.P. 590, p. 174
			No. 1		2			23.8	70.9	5.5	1.0	4.8	83.7	1.6	3.4		14,830	
					3			25.0	75.0		1.0	5.0	88.6	1.6	3.8		15,690	
8	Lower Freeport	3 miles west of Clearfield	Wiley	Face of main heading	1	75,873	2.8	24.7	65.2	7.3	1.4					2.0	14,090	T.P. 590, p. 174
					2			25.4	67.1	7.5	1.4						14,500	
9	Lower Freeport	2½ miles northwest of Philipsburg	Conquest	Face of main heading	1	75,732	3.8	23.3	87.8	5.3	0.9					2.3	14,240	T.P. 590, p. 180
					2			24.2	70.3	5.5	1.0						14,760	
10	Lower Freeport	½ mile north of Mohannon		Pillars of a small mine, 500 ft., in entry, close to Big Fault	1	8,488	2.9	20.5	72.0	4.6	0.8	5.0	82.8	1.4	5.4	2.1	14,510	M 8, p. 71
					2			21.5	73.8	4.7	0.8	4.8	85.3	1.4	3.0		14,850	
					3			22.5	77.5		0.8	5.1	89.5	1.5	3.1		15,699	

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples (Contd.)

Location of mine samples (see Fig. 16)	Coal	Location	Mine	Location in Mine	Sample Condition	Laboratory Number	PROXIMATE PERCENT						ULTIMATE PERCENT				Ash Softening Temp. F°	Reference Sources	
							Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Air-dry Loss Percent			B.T.U.
Lower Freeport	Lower Freeport	3 miles west of Osceola Mills	Fairmount No. 2	Face of 5 room, 2 left heading	1	W17,010	3.1	21.0	69.7	6.2	1.6					14,150	M 8, p. 72		
Lower Freeport	Lower Freeport	3 miles west of Osceola Mills	Fairmount No. 2	Face of 14 room, 8 right heading	1	W17,012	2.4	22.5	68.8	6.3	1.0					14,340	M 6, p. 72		
11	Lower Freeport	3 miles west of Osceola Mills	Fairmount No. 2	Composite of W17,010 & W17,012	1 2 3	11,711	1.8			6.4	1.3	4.7	81.7	1.3	4.8		M 8, p. 72		
										6.8	1.3	4.8	83.2	1.3	3.0				
											1.4	4.9	89.1	1.4	3.2				
12	Lower Freeport	½ mile west of Smoke Run	Eureka No. 22	Face of 1 west entry, main heading 2,600 ft. from mine mouth, lower split of bed	1 2 3	8,489	3.2	21.0	69.3	6.5	0.7	4.9	79.9	1.3	8.7	2.2	14,060	M 0, p. 73	
								22.0	71.3	6.7	0.7	4.7	82.5	1.4	4.0		14,530		
								23.5	76.5		0.8	5.0	88.4	1.5	4.3	15,570			
13	Lower Freeport	Becaria	Glenmar No. 1	Drift	Coal	572	2.3	23.9	66.6	7.2	1.8	4.8	80.0	1.5	4.9	15,340	2,520	R.I. 6261, p. 9	
14	Upper Kittanning	½ miles south of Woodland	Plane	Face of 1 right entry, 1 right heading	1 2 3	8,486	3.2	23.5	65.8	7.5	3.8	4.9	77.7	1.2	4.9	2.6	13,940	M 6, p. 74	
								24.5	67.7	7.8	3.9	4.7	80.2	1.3	2.1		14,390		
								28.5	73.5		4.2	5.1	86.9	1.4	2.4	15,600			
Middle Kittanning	Middle Kittanning	2½ miles southwest of Clearfield	Eagle	1 room, 1 right heading	1	75,739	2.6	21.0	65.0	11.4	2.8					1.8	13,380	2,260	T.P. 590, p. 174
Middle Kittanning	Middle Kittanning	2½ miles southwest of Clearfield	Eagle	Face of 1 right heading	1	75,740	2.1	21.0	65.4	11.5	3.4				1.5	13,330	3,170	T.P. 590, p. 174	
Middle Kittanning	Middle Kittanning	2½ miles southwest of Clearfield	Eagle	Composite of 75,739 & 75,740	1 2 3	75,741	2.4	21.0	65.2	11.4	3.1	4.6	75.4	1.3	4.2	1.7	13,360	T.P. 590, p. 174	
								21.6	66.7	11.7	3.2	4.5	77.3	1.3	2.0		13,690		
								24.4	75.6		3.6	5.1	87.5	1.5	2.3	15,500			
Middle Kittanning	Middle Kittanning	2½ miles northwest of Phillipsburg	Conquest	Face of 1 left heading	1 2	75,731	3.9	21.1	69.0	6.0	2.3				2.8	14,080	2,370	T.P. 590, p. 180	
								22.0	71.7	8.3	2.4						14,650		
Middle Kittanning	Middle Kittanning	1½ miles west of Clearfield	MacTavish & Bailey Prospect	50 ft. in entry	1 2	75,652	3.0	23.3	69.1	4.6	1.1				2.3	14,520	2,380	M 6, p. 68	
								24.0	71.2	4.8	1.1						14,960		
Middle Kittanning	Middle Kittanning	1½ miles west of Clearfield	Another Prospect	100 ft. in entry	1 2	75,626	3.5	22.1	65.8	8.8	2.4				2.8	13,700	2,240	M 0, p. 66	
								22.9	68.2	8.9	2.5						14,200		
Middle Kittanning	Middle Kittanning	2½ miles southwest of Clearfield	Eagle	Face of 1 room, 1 right heading, 500 ft. in entry	1	75,739	2.6	21.0	65.0	11.4	2.8				1.8	13,380	2,260	M 8, p. 66	
Middle Kittanning	Middle Kittanning	2½ miles southwest of Clearfield	Eagle	Face of 1 right heading, 500 ft. in entry	1	75,740	2.1	21.0	65.4	11.5	3.4				1.5	13,330	2,170	M 8, p. 68	
Middle Kittanning	Middle Kittanning	2½ miles southwest of Clearfield	Eagle	Composite of 75,739 & 75,740	1 2 3	75,741	2.4	21.0	65.2	11.4	3.1	4.6	75.4	1.3	4.2	1.7	13,360	M 8, p. 68	
								21.6	66.7	11.7	3.2	4.5	77.3	1.3	2.0		13,690		
								24.4	75.6		3.6	5.1	87.5	1.5	2.3	15,500			

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples (Contd.)

Location of mine samples (see Fig. 16)	Coal	Location	Mine	Location in Mine	Sample Condition	Laboratory Number	PROXIMATE PERCENT						ULTIMATE PERCENT					Temp. $^{\circ}$ F	Reference Sources
							Moisture	Volatiles	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Air-dry Loss	B.T.U.		
19	Middle Kittanning	1 mile south of Gearhartville	Keppart No. 1			Coal 878	2.8	20.7	66.6	9.9	3.5	4.8	76.2	1.3	4.3		15,280	2,150	R.I. 8261, p. 9
20	Middle Kittanning	$\frac{1}{2}$ mile northwest of Graham	Guion	End of 4 straight heading, 8,000 ft. from mine mouth	1 2 3	8,484	2.7	20.0	67.1	10.2	2.0	4.8	76.9	1.3	4.9	1.9	13,610		M 8, p. 67
								21.0	88.5	10.5	2.1	4.6	79.0	1.3	2.5		13,970		
								23.0	77.0		2.3	5.2	88.2	1.4	2.9		15,810		
21	Middle Kittanning	1 mile south of Gearhartville	C. & G. No. 1			Coal 879	2.3	21.9	65.7	10.1	3.7	4.7	76.4	1.3	3.8		15,430	2,150	R.I. 8261, p. 9
22	Lower Kittanning	$2\frac{1}{2}$ miles northwest of Philipsburg	Roden	Face of 2 left heading	1 2	75,735	2.5	21.9	81.8	13.8	4.0					1.7	12,800	2,360	T.P. 590, p. 180
								22.4	83.5	14.1	4.1						13,200		
	Lower Kittanning	$2\frac{1}{2}$ miles northwest of Philipsburg	Alden No. 1	Main heading, last left cross entry	1	90,068	2.4	25.5	58.5	13.8	3.3					1.9	12,940	2,450	T.P. 590, p. 180
	Lower Kittanning	$2\frac{1}{2}$ miles northwest of Philipsburg	Alden No. 1	Last left heading, Back heading	1	90,067	2.2	23.0	62.7	12.1	2.8					1.8	13,240	2,880	T.P. 590, p. 180
	Lower Kittanning	$2\frac{1}{2}$ miles northwest of Philipsburg	Alden No. 1	Last room, Wilson Dunn heading	1	90,068	2.5	24.0	59.2	14.3	3.8					2.0	12,780	2,510	T.P. 590, p. 180
23	Lower Kittanning	$2\frac{1}{2}$ miles northwest of Philipsburg	Alden No. 1	Composite of 90,066 to 90,068	1 2 3	90,069	2.3	24.1	60.1	13.5	3.2	4.5	72.5	1.2	5.1	1.9	12,950		T.P. 590, p. 180
								24.7	61.5	13.8	3.3	4.4	74.2	1.2	3.1		13,290		
								28.7	71.3		3.8	5.1	88.1	1.4	3.6		15,370		
24	Lower Kittanning	1 mile southwest of Coal Run	Smith- Kittanning			Coal 578	3.8	21.0	60.1	15.3	5.2	4.5	89.3	1.2	4.5		15,030	2,380	R.I. 8261, p. 9
	Lower Kittanning	(near Boardman)	Potts Run* No. 3	Face of 3 right entry, main entry 1,400 ft. southwest of mine mouth	1	12,093	2.7	20.8	67.8	8.7	1.6					2.0	13,900	2,530	M 8, p. 65
	Lower Kittanning	(near Boardman)	Potts Run No. 3	On rib, 10 ft. from face of 4 right entry, main entry 1,700 ft. southwest of mine mouth	1	12,094	2.4	20.8	68.1	8.7	1.5					1.7	13,950	3,680	M 8, p. 85
	Lower Kittanning	(near Boardman)	Potts Run No. 3	Face of 3 left entry, main entry 1,680 ft. northeast of mine mouth	1	12,095	2.8	20.7	67.8	8.9	1.4					2.1	13,890	3,010	M 8, p. 85
	Lower Kittanning	(near Boardman)	Potts Run No. 3	Face of main heading, 2,000 ft. north of mine mouth	1	12,098	3.4	20.5	87.7	8.4	1.1					2.7	13,860	3,010	M 8, p. 85
	Lower Kittanning	(near Boardman)	Potts Run No. 3	Face of 12 room, 2 right entry, main entry	1	12,097	3.0	21.2	87.0	8.8	1.4					2.3	13,860	3,010	M 8, p. 85
25	Lower Kittanning	(near Boardman)	Potts Run No. 3	Composite of 12,093 & 12,097	1 2 3	12,098	3.0	21.3	86.9	8.8	1.4	4.7	78.5	1.2	5.4	2.2	13,900		M 8, p. 85
								21.9	89.0	9.1	1.4	4.5	80.9	1.2	2.9		14,320		
								24.1	75.9		1.3	5.0	89.0	1.4	3.1		15,760		

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples (Contd.)

Location of mine samples (see Fig. 16)	Coal	Location	Mine	Location in Mine	Sample Condition	Laboratory Number	PROXIMATE PERCENT						ULTIMATE PERCENT						Ash Softening Temp. F°	B.T.U.	Reference Sources
							Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Air-dry Loss Percent					
26	Lower Kittanning	1 mile southwest of Coal Run	Smith-Kittanning			Coal 577	2.8	21.8	68.5	8.9	1.4	4.8	76.0	1.4	5.5	15,290	2,700	R.I. 6261, p. 9			
	Lower Kittanning	2½ miles east of Coalport	Irvona No. 19	Face of 2 right entry, main heading	1	W17,058	3.0	21.0	68.0	6.0	0.7					13,980		M 6, p. 67			
	Lower Kittanning	2½ miles east of Coalport	Irvona No. 19	Face of 10 face entry, 500 ft. off 5 left entry	1	W17,057	2.0	21.5	88.0	8.5	0.6						14,080		M 6, p. 67		
27	Lower Kittanning	2½ miles east of Coalport	Irvona No. 19	Composite of W17,056 & W17,057	1 2 3	11,702	1.5			8.1 8.2	0.8 0.6	4.7 5.0	80.9 89.4	1.2 1.4	4.3 3.4				M 8, p. 67		
28	Lower Kittanning	1 mile east of Madera	Morgan Run	Face of 4 south entry, 5 right entry	1 2	W20,402	1.5	18.6 18.9	69.4 70.5	70.4 10.6	2.8 2.6					13,820 14,040		M 8, p. 89			
	Lower Kittanning	2 miles north of Madera	Bucher	Face of 9 left entry, 1 cross heading, 3,400 ft. northeast of mine mouth	1	W20,435	2.3	18.7	68.7	10.5	1.0					13,890		M 6, p. 69			
	Lower Kittanning	2 miles north of Madera	Bucher	Face of 8 right heading, 3,800 ft. northeast of mine heading	1	W20,436	2.1	20.0	68.9	9.0	1.5					13,980		M 8, p. 69			
	Lower Kittanning	2 miles north of Madera	Bucher	Face of 10 right heading, 4,500 ft. northeast of mine mouth	1	W20,437	2.4	19.9	88.2	9.5	1.2					13,889		M 8, p. 89			
	Lower Kittanning	2 miles north of Madera	Bucher	Face of 7 left heading, 3,000 ft. northeast of mine mouth	1	W20,438	2.3	19.5	70.2	6.0	1.2					14,110		M 6, p. 69			
	Lower Kittanning	2 miles north of Madera	Bucher	Face of 7 right heading, 3,200 ft. northeast of mine mouth	1	W20,439	2.3	20.4	69.0	8.3	1.2					13,690		M 6 p. 69			
29	Lower Kittanning	2 miles north of Madera	Bucher	Composite of W20,435 & W20, 439	1 2 3	12,376	0.8	21.4 21.5 23.6	88.4 69.1 78.2	9.4 9.4 7.5	1.4 1.4 1.5	4.5 4.4 4.9	60.1 80.7 89.1	1.1 1.1 1.2	3.6 2.9 3.2		14,020 14,140 15,610		M 6 p. 69		
	Lower Kittanning	2 miles west of Phillipsburg (Centre County)	Guion	Face of 1 right heading, 2 right entry, 4,000 ft. from mine mouth	1	W20,369	2.0	20.0	69.9	8.1	1.1					14,090		M 6, p. 72			
	Lower Kittanning	2 miles west of Phillipsburg (Centre County)	Guion	Face of 2 right heading, 4,000 ft. from mine mouth	1	W20,370	2.0	21.5	89.2	7.3	1.0					14,230		M 6, p. 72			
	Lower Kittanning	2 miles west of Phillipsburg (Centre County)	Guion	Back heading, 1 right entry, 2,500 ft. from mine mouth	1	W20,371	2.9	16.4	69.1	9.6	2.2					13,660		M 6, p. 72			

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples (Contd.)

Location of mine samples (see Fig. 16)	Coal	Location	Mine	Location in Mine	Sample Condition	Laboratory Number	PROXIMATE PERCENT						ULTIMATE PERCENT					Abb Softening Temp. F°	B.T.U.	Reference Sources
							Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Air-dry Loss Percent				
30	Lower Kittanning	2 miles west of Philipsburg (Centre County)	Culon	50 ft. from face of 1 left heading, 2 right entry	1	W20,372	2.0	19.2	70.1	8.7	1.5					14,020		M 8, p. 72		
	Lower Kittanning	2 miles west of Philipsburg (Centre County)	Culon	Face of 1 left heading, 1 right entry, 2,200 ft. from mine mouth	1	W20,373	2.4	19.8	67.5	70.5	1.9					13,570		M 8, p. 72		
	Lower Kittanning	2 miles west of Philipsburg (Centre County)	Culon	Composite of W20,369 to W20,373	1 2 3	12,367	0.9	21.8	68.5	9.0	2.0	4.6	79.5	1.3	3.8	14,060		M 8, p. 72		
31	Lower Kittanning	3½ miles southwest of Philipsburg (Centre County)	Acme No. 2	Face of 3 left heading, Hawk Run entry, ½ mile southwest of mine mouth	1	10,258	3.8	19.8	89.3	7.3	2.5				3.4	13,920	2,430	M 8, p. 73		
	Lower Kittanning	3½ miles southwest of Philipsburg (Centre County)	Acme No. 2	Last room, 1 left entry, Hawk Run west of mine mouth	1	10,259	2.8	19.7	89.8	7.7	2.2				2.3	14,040		M 8, p. 73		
	Lower Kittanning	3½ miles southwest of Philipsburg (Centre County)	Acme No. 2	Composite of 10,258 & 10,259	1 2 3	10,284	3.4	19.9	69.2	7.5	2.4	4.8	78.9	1.3	5.1	13,950		M 8, p. 73		
32	Lower Kittanning	3½ miles southeast of Smoke Run	Viola	Face of 9 left heading, beyond 18 room, 1,300 ft. from main haulageway	1	11,748	3.8	20.4	68.9	6.9	1.1				3.1	14,060	3,010	M 8, p. 73		
	Lower Kittanning	3½ miles southeast of Smoke Run	Viola	Face of second slant to right, just beyond 3 room	1	11,749	3.7	20.4	68.8	7.1	0.9				2.9	14,080	2,840			
	Lower Kittanning	3½ miles southeast of Smoke Run	Viola	Face of main entry, 4,750 ft. southwest of mine mouth	1	11,750	3.7	20.3	67.6	8.4	1.2				2.9	13,870	2,600	M 8, p. 73		
33	Lower Kittanning	3½ miles southeast of Smoke Run	Viola	Composite of 11,748 to 11,750	1 2 3	11,751	3.7	20.3	68.4	7.6	1.3	4.9	78.9	1.2	8.1	13,970		M 8, p. 73		
	Lower Kittanning	½ mile northwest of Graham	Hardley	2,700 ft. in, room at end of main heading, beyond entry 7	1 2 3	8,485	8.2	19.5	65.8	8.5	3.19	5.02	75.09	1.02	7.18	13,350		U.S.B.M. Bull. 22 p. 167		
	Lower Kittanning	3½ miles southwest of Philipsburg (Centre County)	Acme No. 2	Packer heading, about ¾ mile northeast of entrance	1 2 3	10,260	2.28	20.55	89.80	7.39	1.50				1.7	14,218		U.S.B.M. Bull. 22 p. 187		

Table 11. Proximate and Ultimate Analyses of Coal Mine Samples (Contd.)

Location of mine samples (see Fig. 16)	Coal	Location	Mine	Location in Mine	Sample Condition	Laboratory Number	PROXIMATE PERCENT					ULTIMATE PERCENT					Temp. F.	Ash Softening	Reference Sources
							Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Air-dry Loss				Percent
Lower Kittanning		3½ miles southwest of Philipsburg (Centre County)	Acme No. 2	Pillar in room 1 off left entry, about ¾ mile northeast of entrance	1	10,261	3.12	20.17	89.17	7.54	1.97					14.002		U.S.B.M. Bull. 22 p. 167	
					2			20.62	71.40	7.78	2.03					14.452			
					3			22.58	77.42		2.20					15.673			
34 Lower Kittanning		3½ miles southwest of Philipsburg (Centre County)		Composite of 10,260 & 10,261	1	10,265	2.80	20.21	69.80	7.39	1.87	5.00	79.86	1.34	4.72	2.1	14.080	U.S.B.M. Bull. 22 p. 167	
					2			70.70	71.81	7.60	1.72	4.63	82.18	1.38	2.29		14.485		
					3			22.50	77.50		1.68	5.23	88.94	1.49	2.48		15.677		
Brookville		2 miles south of Houtzdale	Mountain Branch	Face of 2 left heading	1	W46,818	0.8	23.3	84.9	11.0	3.5					13.830	T.P. 590, p. 170		
Brookville		2 miles south of Houtzdale	Mountain Branch	Face of main heading	1	W46,617	5.0	21.0	65.3	6.1	2.8					13.260	T.P. 590, p. 178		
Brookville		2 miles south of Houtzdale	Mountain Branch	1 dip heading, 1 left heading	1	W46,818	1.9	23.6	81.9	12.8	3.3					13.160	T.P. 590, p. 176		
Brookville		2 miles south of Houtzdale	Mountain Branch	Face of 3 left heading	1	W48,619	2.1	22.5	84.0	11.4	3.9					13.290	T.P. 590, p. 176		
Brookville		2 miles south of Houtzdale	Mountain Branch	Last room, 1 left heading	1	W48,820	1.9	23.1	62.6	12.2	4.1					13.280	T.P. 590, p. 176		
35 Brookville		2 miles south of Houtzdale	Mountain Branch	Composite of W46,816 to W46,820	1	19,615	2.3	22.8	83.9	11.0	3.6	4.4	75.2	1.1	4.7		13.380	T.P. 590, p. 178	
					2			23.4	65.3	11.3	3.7	4.3	77.0	1.2	2.5		13.680		
					3			26.3	73.7		4.2	4.6	86.8	1.3	2.9		15,420		
36 Brookville		(near Madera)	Sylvania No. 1	Face of 1 right entry, 5,000 ft from mine mouth	1	8,490	2.4	20.5	70.8	6.3	1.7	4.9	60.9	1.4	4.9	1.6	14,330	M 8, p. 89	
					2			21.0	72.6	6.4	1.7	4.7	82.9	1.5	2.8		14,680		
					3			22.5	77.5		1.6	5.0	88.6	1.6	3.0		15,690		
37 Brookville		¼ mile southeast of Moshannon	Union No. 2	Face of 2 left entry, main entry, 1,000 ft. from mine mouth	1	8,480	2.8	20.7	87.5	8.9	2.9	5.0	77.6	1.0	4.6	1.9	13,810		
					2			21.3	69.5	9.2	2.9	4.8	79.8	1.0	2.3		14,200		
					3			23.5	76.5		2.3	5.3	67.9	1.1	2.5		15,630		
38 Brookville		1 mile west of Madera	Marks No. 1	Coal		880	3.3	20.1	65.5	11.1	2.5	4.8	75.2	1.2	5.2	15,140	2,800 R.I. 6281, p. 9		

Sample Condition: 1 - As received; 2 - Dry Basis; 3 - Moisture and Ash free.

• No. 25 actually Clarion (Brookville coal)

Table 12. Proximate Analyses of Coal as Shipped and Delivered

Location Near	Mine	Size of Coal	Moisture	Proximate Analysis					B. T. U. Per Pound				No. of Analyses	Ash-fusion		Reference Source	
				Volatiles Matter	Fixed Carbon	Ash	Sulfur	As Recd.	Dry Coal	Moisture	Averaged	Softening Temp.		No. of Analyses			
Upper Freeport Coal																	
Houtzdale	West End	ROM	3.0	22.8	70.0	7.2	0.8	13,990	14,420	15,540	1	2570	1	T.P. 590			
Houtzdale	Moran Slope	ROM	2.5	24.6	63.9	11.5	2.0	13,470	13,810	15,610	1	2370	1	T.P. 590			
Osceola Mills	Center	ROM	3.4	24.5	63.5	10.2	2.2	13,450	13,920	15,500	1	2300	1	T.P. 590			
Osceola Mills	Superior #1	2" lump	2.1	24.5	63.0	12.5	3.1	13,310	13,600	15,540	1	2240	1	T.P. 645			
Osceola Mills	Superior #1	0 x 2"	2.7	24.4	64.5	11.1	2.7	13,480	13,850	15,580	1	2260	1	T.P. 645			
Osceola Mills	Superior #1°	ROM	2.6	24.8	65.6	9.6	3.2	13,720	14,090	15,590	2	.....	.....	T.P. 645	
Osceola Mills	Superior #1°	ROM	2.8	24.9	66.0	9.1	2.1	13,720	14,120	15,530	2	.....	.....	T.P. 645	
Osceola Mills	Superior #1°	2" lump	3.0	24.8	65.2	10.0	2.5	13,610	14,030	15,590	4	.....	.....	T.P. 645	
Osceola Mills	Superior #1°	2" x 5"	3.1	23.6	66.7	9.7	1.7	13,630	14,070	15,580	3	.....	.....	T.P. 645	
Morann	Standard #5°	Nut & Slack	2.2	24.5	64.8	10.7	2.4	13,590	13,900	15,570	7	2310	1	T.P. 645			
° Mined with Lower Freeport																	
Lower Freeport Coal																	
Beccaria	Glenmar #1	ROM	1.7	23.7	68.1	8.8	1.0	13,940	14,180	15,550	7	.....	.....	M 6	
Beccaria	Glenmar #1	ROM	1.4	24.2	68.7	7.1	1.2	14,280	14,480	15,590	1	2620	1	M 6			
Beccaria	Leland #10	ROM	2.4	23.2	69.1	7.7	0.7	14,070	14,400	15,610	1	2940	1	M 6			
Beccaria	Leland #10	¾ x 2	2.2	23.8	68.4	7.8	0.7	14,030	14,340	15,560	1	2910-	1	T.P. 645			
Beccaria	Leland #10	0 x 1¼	2.7	23.9	68.7	7.4	0.7	14,020	14,410	15,570	1	2910-	1	T.P. 645			
Beccaria	Leland #10	0 x ¾	2.8	24.0	68.7	7.3	0.7	14,060	14,460	15,590	1	2910-	1	T.P. 645			
Houtzdale	Coalmont-	ROM	5.4	21.3	64.7	14.0	1.1	12,370	13,080	15,210	12	.....	.....	M 6	
Moshannon																	
Osceola Mills	Daywood #1	ROM	2.2	24.8	68.3	6.9	1.9	14,220	14,530	15,610	1	2390	1	T.P. 590			
Osceola Mills	Daywood #1	ROM	1.9	24.0	68.5	9.5	2.0	14,050	14,050	15,520	3	.....	.....	T.P. 590	
Ramey	Bulah #1	ROM	3.1	22.9	67.5	9.6	1.8	13,670	14,110	15,610	1	2390	1	T.P. 590			
Ramey	Bulah #1	1" nut & slack	4.2	22.8	69.0	8.2	1.5	13,770	14,370	15,650	1	2550	1	T.P. 590			
Ramey	Bulah #4	ROM	3.6	16.4	78.1	5.5	0.6	14,280	14,810	15,670	38	.....	.....	M 6	
Ramey	King	ROM	4.0	25.3	66.6	8.1	2.3	13,780	14,350	15,610	2	2200	2	T.P. 590			
Ramey	Mt. Vernon #10	ROM	2.6	24.2	66.7	9.1	1.3	13,570	13,930	15,320	2	.....	.....	T.P. 590	
Ramey	Vulcan #2	ROM	2.6	24.8	66.5	8.7	1.7	13,730	14,100	15,440	47	.....	.....	M 6	

Table 12. Proximate Analyses of Coal as Shipped and Delivered (Contd.)

Location Near	Mine	Size of Coal	Moisture	Proximate Analysis					B. T. U. Per Pound			Ash-fusion		Reference Source
				Volatle Matter	Fixed Carbon	Ash	Sulfur	As Recd.	Dry Coal	Moisture	Averaged Analyses	Softening Temp.	No. of Analyses	
Osceola Mills	Reading #2	ROM	2.0	21.7	67.0	11.3	3.7	13,510	13,780	15,540	1	2310	1	M 6
	Upper Kittanning Coal													
	Middle Kittanning Coal													
	Imperial #3	ROM	2.4	21.4	68.5	9.8	1.8	13,700	14,040	15,570	39	.....	.....	T.P. 645
	Imperial #3	1 1/4" lump	2.4	20.9	69.7	9.4	1.7	13,810	14,150	15,620	8	.....	..	T.P. 645
	Imperial #3	1" lump	2.4	19.7	68.1	12.2	0.9	13,420	13,750	15,650	1	2550	1	T.P. 645
	Imperial #3	1 x 6	2.3	21.0	69.1	9.9	2.1	13,720	14,040	15,580	3	.....	.....	T.P. 645
	Imperial #3	1 x 6	1.2	21.1	68.9	10.0	3.8	13,850	14,020	15,580	1	.....	.....	T.P. 645
	Imperial #3	1 1/2 x 5"	2.4	20.9	67.7	11.4	2.7	13,450	13,790	15,560	1	.....	.....	T.P. 645
	Imperial #3	2 x 3"	3.1	20.6	69.2	10.2	2.7	13,600	14,040	15,630	1	.....	..	T.P. 645
	Imperial #3	1 1/4 x 3"	3.1	20.1	69.9	10.0	1.8	13,630	14,070	15,640	1	2530	1	T.P. 645
	Imperial #3	3/4 x 2	0.7	21.0	69.6	9.4	1.5	14,100	14,200	15,670	2	2650	1	T.P. 645
	Imperial #3	1/4 x 1	2.3	20.3	69.3	10.4	1.7	13,710	14,030	15,660	1	2590	1	T.P. 645
	Imperial #3	0 x 1/4	2.9	20.7	70.2	9.1	2.0	13,810	14,220	15,650	1	2500	1	T.P. 645
	Lower Kittanning Coal													
	Beccaria	Black Oak	ROM	4.7	22.9	65.7	11.7	1.2	12,880	13,520	15,260	2	.....	.....	M 6
Boardman	Potts Run #3	ROM	3.8	22.0	69.3	8.7	2.5	13,630	14,170	15,620	3	2410	3	T.P. 590
Houtzdale	Brookwood Shaft	ROM (Mod)	2.4	20.7	69.8	9.5	1.2	13,790	14,130	15,620	1	2850	1	T.P. 645
Houtzdale	Brookwood Shaft	0 x 3/4	3.5	20.4	69.5	10.1	1.2	13,580	14,060	15,640	1	2750	1	T.P. 645
Houtzdale	Clyde #28	ROM (Mod)	2.5	21.0	69.9	9.1	1.6	13,840	14,190	15,610	4	2710	4	T.P. 590
Houtzdale	Clyde #28	ROM	2.9	21.8	70.0	8.2	1.0	13,880	14,300	15,580	1	2870	1	T.P. 590
Houtzdale	Clyde #28	1 x 2 1/2	1.3	21.5	69.2	9.3	1.2	13,940	14,120	15,570	5	.....	.....	T.P. 590
Houtzdale	Clyde #28	1 1/4" Nut & Slack	3.2	21.8	69.4	8.8	1.3	13,830	14,280	15,660	1	2810	1	T.P. 590
Houtzdale	Clyde #28	1 1/4" Nut & Slack	3.4	22.0	69.4	8.6	1.1	13,800	14,290	15,630	1	2860	1	T.P. 590
Houtzdale	Elizabeth	ROM	2.8	22.3	66.1	11.6	1.4	13,310	13,690	15,490	1	.....	.....	M 6
Houtzdale	Hale #1	ROM	2.8	24.1	64.7	11.2	1.4	13,210	13,590	15,310	1	.....	.....	M 6
Houtzdale	Imperial #2	ROM	2.0	22.2	65.3	12.5	2.2	13,260	13,530	15,470	1	2580	1	T.P. 645
Houtzdale	Imperial #2	ROM	2.0	21.9	68.6	9.5	1.1	13,910	14,190	15,680	1	.....	.....	T.P. 590

Table 12. *Proximate Analyses of Coal as Shipped and Delivered (Contd.)*

Location Near	Mine	Size of Coal	Proximate Analysis				B. T. U. Per Pound			No. of Analyses Averaged	Ash-fusion		Reference Source
			Moisture	Volatiles	Fixed Carbon	Ash	Sulfur	As Recd.	Dry Coal	Moisture Ash-free	Softening Temp.	No. of Analyses	
Houtzdale	Imperial #2	2 x 5	1.9	21.8	69.5	8.7	1.3	14,050	14,320	15,680	5		T.P. 590
Houtzdale	Imperial #2	1 1/4 x 3 1/4"	1.5	21.4	68.6	10.0	1.3	13,880	14,090	15,660	16		T.P. 590
Houtzdale	Imperial #3	ROM	2.2	21.7	69.6	8.7	1.0	14,030	14,350	15,710	1	2870	T.P. 590
Houtzdale	Imperial #3	Lump	1.8	20.5	70.6	8.9	1.6	14,020	14,280	15,670	1		T.P. 590
Houtzdale	Imperial #3	3/4" Slack	1.9	21.4	70.2	8.4	1.3	14,060	14,340	15,660	1	2790	T.P. 590
Houtzdale	Imperial #3	3/4" Slack	3.3	22.2	69.6	8.2	1.2	13,910	14,380	15,660	9	2820	T.P. 590
Houtzdale	Imperial #3	3/4" Slack	3.0	21.4	70.6	8.0	1.6	13,980	14,410	15,660	4	2630	T.P. 590
Houtzdale	Imperial #4	1 1/4" Nut & Slack	2.2	23.0	65.2	11.8	2.1	13,410	13,720	15,550	1	2600	T.P. 590
Houtzdale	Mascot #1	ROM	1.6	21.5	66.1	12.4	2.3	13,390	13,610	15,540	1	2510	T.P. 590
Houtzdale	Mascot #1	ROM	1.2	21.6	66.3	12.1	3.1	13,450	13,620	15,500	1	2330	T.P. 590
Madera	Mid Penn #4	ROM	1.5	20.9	68.1	11.0	3.5	13,620	13,830	15,540	1	2310	T.P. 590
Madera	Mid Penn #7	ROM	2.2	21.6	69.0	9.4	2.1	13,830	14,140	15,140	1		T.P. 590
Madera	Universal #1	ROM	1.9	19.9	67.4	12.7	3.2	13,240	13,500	15,460	4	2440	T.P. 645
Madera	Universal #1	0 x 1 1/4"	2.2	18.1	68.6	13.3	2.4	13,180	13,470	15,540	1		T.P. 645
Madera	Universal #1	0 x 3/4"	3.4	18.8	68.0	13.2	2.6	13,020	13,480	15,530	1	2540	T.P. 645
Madera	Yorkshire	ROM	2.0	19.6	69.9	10.5	2.6	13,580	13,860	15,490	3		T.P. 590
Madera	Yorkshire	ROM	5.6	19.6	70.7	9.7	2.7	13,280	14,070	15,580	4		T.P. 590
Madera	Yorkshire	ROM	1.5	19.4	68.4	12.2	3.0	13,400	13,600	15,490	1	2330	T.P. 590
Madera	Yorkshire	ROM	1.3	19.6	68.4	12.0	3.0	13,480	13,660	15,520	1	2360	T.P. 590
Madera	Yorkshire	ROM	1.7	19.6	68.5	11.9	2.9	13,420	13,650	15,490	18		T.P. 590
Madera	Yorkshire	ROM	1.8	19.8	70.1	10.1	2.9	13,740	13,990	15,560	1		T.P. 590
Madera	Yorkshire	ROM	2.6	19.0	70.0	11.0	2.6	13,490	13,850	15,570	1	2530	T.P. 590
Madera	Yorkshire	ROM	1.5	18.4	67.7	13.9	2.9	13,120	13,320	15,470	3		T.P. 590
Madera	Yorkshire	ROM	1.6	19.3	70.3	10.4	2.7	13,700	13,920	15,540	2	2310	T.P. 590
Madera	Yorkshire	3/4 x 1 3/4" Nut	1.8	17.8	66.1	16.1	3.7	12,780	13,020	15,520	1	2480	T.P. 590
Madera	Yorkshire	ROM	2.3	18.6	70.3	11.1	2.6	13,520	13,840	15,560	1	2490	T.P. 590
Osceola Mills	Baltic Shaft	ROM	1.9	22.2	68.8	9.0	1.8	13,950	14,220	15,630	1	2540	T.P. 590
Osceola Mills	Du Shan #1	ROM	1.4	25.2	64.2	10.4	2.1	13,820	14,010	15,640	1	2560	T.P. 590
Osceola Mills	Du Shan #1	ROM	2.4	23.5	68.2	8.3	1.0	14,030	14,370	15,670	1	2910-	T.P. 645
Osceola Mills	Du Shan #3	2" lump	3.7	23.0	69.2	7.8	1.2	13,730	14,260	15,470	1	2870	T.P. 645

Table 12. Proximate Analyses of Coal as Shipped and Delivered (Contd.)

Location Near	Mine	Size of Coal	Moisture	Proximate Analysis					B. T. U. Per Pound			No. of Analyses Averaged	Ash-fusion		Reference Source
				Volatile Matter	Fixed Carbon	Ash	Sulfur	As Rec'd.	Dry Coal	Moisture Ash-free	Temp.		No. of Analyses		
Osceola Mills	Du Shan #3	0 x 2"	5.8	23.7	69.9	6.4	1.2	13,640	14,470	15,460	1	2870	1	T.P. 645	
Osceola Mills	Imperial #11	0 x 2" (Crushed to 2")	2.3	24.7	65.5	9.8	1.2	13,750	14,060	15,590	1	2790	1	T.P. 590	
Osceola Mills	Imperial #11	0 x 2" (Crushed to ¾")	2.0	25.2	65.9	8.9	1.3	13,940	14,220	15,610	1	2770	1	T.P. 590	
Osceola Mills	Imperial #12	ROM	3.2	24.1	66.6	9.3	1.3	13,760	14,210	15,670	1	2760	1	T.P. 590	
Osceola Mills	Moshannon #10	ROM	2.0	23.2	64.8	12.0	3.2	13,390	13,660	15,520	6	.....	1	T.P. 645
Osceola Mills	Moshannon #10	2" lump	1.1	23.6	63.9	12.5	3.7	13,390	13,540	15,480	1	.....	1	T.P. 645
Osceola Mills	Peerless #4	ROM	1.2	24.6	66.4	9.0	1.5	14,120	14,280	15,700	1	2680	1	T.P. 590	
Ramey	Brookwood Shaft	ROM	2.6	22.9	69.5	7.6	1.3	14,060	14,440	15,620	1	2680	1	T.P. 590	
Sandy Ridge	Leader #1	ROM	4.8	24.6	57.2	18.2	3.8	11,850	12,460	15,230	1	.....	1	M 6
Smoke Run	Lena #1	ROM	4.7	20.2	69.3	10.5	3.2	13,220	13,870	15,500	1	.....	1	T.P. 590
West Decatur	Red Jacket #4	ROM	1.9	23.8	62.4	13.8	2.0	13,050	13,300	15,430	2	.....	1	T.P. 590
West Decatur	Red Jacket #4	ROM	1.6	24.3	69.3	11.8	2.1	13,390	13,610	15,430	9	.....	1	T.P. 590
West Decatur	Red Jacket #4	ROM	3.4	23.1	62.9	14.0	2.1	12,870	13,330	15,500	1	2570	1	T.P. 590	
Clarion Coal															
Houtzdale	Red Top #2	ROM	2.2	22.0	65.4	12.6	3.5	13,200	13,500	15,440	1	2430	1	T.P. 590	
Houtzdale	Red Top #2	ROM	1.8	23.6	66.1	10.3	3.2	13,640	13,890	15,480	1	2440	1	T.P. 590	
Houtzdale	Red Top #2	ROM	2.6	22.5	65.9	11.6	3.1	13,200	13,550	15,330	1	.....	1	T.P. 590
Osceola Mills	Bear Run #1	ROM	1.4	23.1	61.7	15.2	4.3	12,900	13,080	15,420	5	.....	1	M 6
Osceola Mills	Bear Run #1	ROM	3.8	23.5	61.7	14.8	4.7	12,530	13,020	15,280	2	.....	1	M 6
Osceola Mills	Burtner #2	ROM	1.4	24.2	62.7	13.1	2.5	13,290	13,480	15,520	1	2390	1	T.P. 590	
Osceola Mills	Claene #1	ROM	0.8	22.8	64.9	12.3	3.5	13,400	13,510	15,410	1	2440	1	T.P. 590	

Table 13. *Summary of Petrographic analyses of coals in Houtzdale quadrangle.*

<i>Coal Horizon</i>	<i>Vitrinoids</i>	<i>Exinoids</i>	<i>Micrinoids</i>	<i>Semi-fusinite</i>	<i>Fusinite</i>	<i>Ash</i>	<i>Number Sampled</i>
CONEMAUGH							
Mahoning coal	84.1	2.3	3.7	2.4	7.5	14.1	1
Upper Freeport rider coal	79.0	3.4	6.8	2.4	8.4	16.3	1
ALLEGHENY							
Upper Freeport coal (E)	92.4	2.0	2.3	0.6	2.7	8.2	8
Lower Freeport coal (D)	88.7	2.3	4.2	1.0	3.8	7.5	11
Upper Kittanning coal (C')	83.6	3.5	3.5	1.3	8.1	12.1	6
Middle Kittanning coal (C)	89.4	3.6	3.3	0.9	2.8	8.6	8
Lower Kittanning coal							
B-5	87.1	2.3	3.0	1.8	5.8	14.1	3
B-4	93.2	3.5	2.2	0.3	0.8	6.6	6
B-3b	86.2	5.7	4.7	0.7	2.7	8.0	8
B-3a	92.2	3.1	2.4	0.6	1.7	6.5	17
B-2 (B)	84.7	4.2	4.9	1.4	4.8	12.3	5
B-1	86.5	2.4	4.6	1.6	4.9	9.2	4
Clarion coals (A', A)							
Clarion 2	83.3	4.8	5.9	1.0	5.0	9.0	4
Clarion 1	87.4	2.9	3.9	1.1	4.7	7.1	5
POTTSVILLE							
Mercer (undifferentiated)	78.6	3.3	8.0	3.5	6.6	12.8	3

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APPENDIX

CONEMAUGH COALS

SAMPLE NO: 85-C-38Mahoning

COMPANY: Thompson Mine

LOCATION: Glen Richey 7½ Quadrangle
14,200' North 40° 55'
10,300' East 78° 30'

inches	V	E	M	SF	F	ASH	
0-7	86.0	2.8	3.6	2.2	5.4	8.9	
7-19	83.4	2.0	4.6	3.4	6.6	15.3	Canneloid
19-29	83.6	2.4	2.8	1.2	10.0	16.3	
	V	E	M	SF	F	ASH	
Average	84.1	2.3	3.7	2.4	7.5	14.1	

SAMPLE NO: 85-C-22Upper Freeport rider

COMPANY: Simca Mining

LOCATION: Glen Richey 7½ Quadrangle
10,200' South 41° 00'
7,300' West 78° 25'

	V	E	M	SF	F	ASH
Average	79.0	3.4	6.8	2.4	8.4	16.3

Local block in faulty sandstone -10 feet across
Thickness 0 - 4'+
Cut out by slumping and sandstone. No accurate
bed thickness available at time of sampling.
Operator reported pods up to 6' thick

SAMPLE NO: 85-C-85Upper Freeport rider

COMPANY: unknown

LOCATION: Ramey 7½ Quadrangle
4,400' North 40° 45'
8,600' West 78° 25'

	V	E	M	SF	F	ASH
Average						

At crop ±2' thick, 15.0 % ash, sampled
canneloid with irregular clay veins. Too
weathered for microscopic examination.

UPPER FREEPORT COALS

SAMPLE NO: 85-C-8 Upper Freeport
 COMPANY: Thompson Coal Co.
 LOCATION: Glen Richey Quadrangle
 12,000' North 40° 55'
 6,900' East 78° 30'

inches	V	E	M	SF	F	ASH
0-8	92.8	1.2	2.8	—	3.2	4.8
8-18	98.4	0.4	1.2	—	—	6.3
18-27	91.4	0.6	2.0	2.0	4.0	11.7
27-31	94.0	1.2	2.4	—	2.4	15.5
	V	E	M	SF	F	ASH
Average	94.3	0.8	2.0	0.6	2.3	8.7

Sample badly weathered

SAMPLE NO: 85-C-23 Upper Freeport
 COMPANY: Simca Coal Co.
 LOCATION: Glen Richey Quadrangle
 10,500' South 41° 00'
 7,300' West 78° 25'

inches	V	E	M	SF	F	ASH	
0-2	88.4	2.2	3.8	0.6	5.0	8.5	Clay ½"
2½-13	91.0	1.4	1.6	0.0	3.0	6.9	
13½-20½	94.0	1.4	1.6	0.0	3.0	6.9	Clay ½"
20½-29	86.2	1.0	4.0	0.2	8.6	15.3	
	V	E	M	SF	F	ASH	
Average	90.1	1.7	2.7	0.5	5.0	8.4	

SAMPLE NO: 85-C-27 Upper Freeport
 COMPANY: unknown Strip mine
 LOCATION: Glen Richey 7½ Quadrangle
 4,000' North 40° 55'
 11,200' East 78° 30'

inches	V	E	M	SF	F	ASH
0-5	88.0	2.0	3.8	0.6	5.6	9.6
5-10	88.8	3.8	2.4	0.6	4.4	3.1
10-22	94.8	1.2	2.0	0.0	2.0	6.3
22-28	92.0	1.0	3.8	0.2	3.0	17.5
28-30						26.5
30-31						26.5
	V	E	M	SF	F	ASH
Average	91.8	1.8	2.8	0.3	3.3	8.7

* excluded from totals

SAMPLE NO: 85-C-28 Upper Freeport
 COMPANY: Thompson
 LOCATION: Glen Richey Quadrangle
 12,000' North 40° 55'
 9,700' East 78° 30'

inches	V	E	M	SF	F	ASH
0-9	89.6	2.8	3.4	0.8	3.4	5.2
9-22	96.4	1.6	0.8	—	1.2	4.4
22-29	93.6	2.0	1.6	0.8	2.0	13.4
31-32	96.8	0.2	1.6	—	1.4	13.4
	V	E	M	SF	F	ASH
Average	93.7	2.0	1.8	0.4	2.1	7.0

UPPER FREEPORT COALS

SAMPLE NO: 85-C-61 Upper Freeport

COMPANY: Elliott Coal Co.
 LOCATION: Houtzdale 7½ Quadrangle
 10,500' North 40° 50'
 9,400' West 78° 20'

inches	V	E	M	SF	F	ASH
0-6	89.4	4.2	3.8	1.2	1.4	5.6
6-10	88.4	7.0	2.0	1.6	1.0	4.8
10-17	94.2	3.0	1.6	—	1.2	4.8
17-23	96.0	1.6	1.2	—	1.2	6.6
23½-28	92.0	1.8	3.0	0.2	3.0	12.8
28-32	89.6	1.6	4.4	1.4	3.0	17.1
	V	E	M	SF	F	ASH
Average	92.0	3.1	2.6	0.6	1.7	8.0

SAMPLE NO: 85-C-83 Upper Freeport

COMPANY: unknown - near crop
 LOCATION: Ramey 7½ Quadrangle
 3,800' North 40° 45'
 7,000' West 78° 25'

inches	V	E	M	SF	F	ASH
0-4	96.2	2.0	1.4	—	0.4	6.4
4-9	95.2	1.8	1.4	—	1.6	6.2
9½-16½	94.2	2.0	1.4	—	2.4	8.3
17-23	92.6	3.2	1.0	—	3.2	12.6
23½-29½	91.6	3.8	2.4	0.4	1.8	13.3
	V	E	M	SF	F	ASH
Average	93.8	2.6	1.5	0.1	2.0	9.6

Sample badly weathered

SAMPLE NO: 85-C-84 Upper Freeport

COMPANY: unknown
 LOCATION: Ramey 7½ Quadrangle
 4,600' North 40° 45'
 8,600' West 78° 25'

inches	V	E	M	SF	F	ASH
0-5	91.4	1.8	5.0	1.0	0.8	4.8
5-15	92.8	1.6	2.2	0.4	3.0	5.3
16-23½	89.0	1.2	3.2	2.6	4.0	6.4
24-26½	96.4	0.6	1.0	1.0	1.0	5.3
27½-30½	*	—	—	—	—	—
	V	E	M	SF	F	ASH
Average	91.7	1.4	2.9	1.3	2.7	5.5

Some layers weathered

* Not analyzed

SAMPLE NO: 85-C-89 Upper Freeport

COMPANY: Ryan Bros. Coal Co.
 LOCATION: Glen Richey Quadrangle
 1,800' South 40° 55'
 4,800' East 78° 30'

inches	V	E	M	SF	F	ASH
0-7	88.2	5.2	3.6	0.6	2.4	7.8
7-12	90.6	3.8	0.8	—	4.8	3.7
12-18½	96.8	1.2	0.8	—	1.2	7.8
18½-23	93.6	1.6	2.0	1.0	1.8	16.7
23-28	90.4	0.4	3.2	2.0	4.0	13.9
	V	E	M	SF	F	ASH
Average	91.9	2.6	2.1	0.7	2.7	9.6

LOWER FREEPORT COALS

SAMPLE NO: 85-C-7 Lower Freeport
 COMPANY: road cut *
 LOCATION: Glen Richey 7½ Quadrangle
 12,400' North 40° 55'
 6,200' East 78° 30'

inches	V	E	M	SF	F	ASH	
0-2							High ash coal
2-9	85.4	0.4	7.8	1.4	5.0	8.7	
9-16	88.0	1.2	4.2	1.0	5.6	9.8	
16-16½							Clay parting
16½-26	87.4	1.2	4.4	0.6	6.4	9.5	
26-29							Gray clay
29-35	86.9	1.2	4.4	0.6	6.4	9.5	
35-38	95.4	1.2	3.0	0.2	0.2	11.8	
	V	E	M	SF	F	ASH	
Average	87.7	1.0	5.2	1.1	5.0	9.5	

* Poorly exposed and preserved

SAMPLE NO: 85-C-24 Lower Freeport rider
 COMPANY: Simca Mine
 LOCATION: Glen Richey 7½ Quadrangle
 10,100' South 41° 00'
 7,000' West 78° 25'

inches	V	E	M	SF	F	ASH	
0-29	Weathered outcrop no microscopy					8.8	
	V	E	M	SF	F	ASH	
Average							

SAMPLE NO: 85-C-25 Lower Freeport
 COMPANY: Simca Mine
 LOCATION: Glen Richey 7½ Quadrangle
 10,400' South 41° 00'
 6,900' West 78° 25'

inches	V	E	M	SF	F	ASH	
0-2	86.0	4.8	5.8	1.4	2.0	20.2	
2-5	89.6	2.6	3.8	1.8	2.2	10.6	
5-10	88.4	1.6	4.2	1.0	4.8	8.2	
10-21	90.2	2.0	2.6	—	5.2	7.6	
21-25	94.4	0.2	3.6	0.6	1.2	9.3	
25-26½							
26½-33	92.0	1.2	4.2	0.8	1.8	10.2	
	V	E	M	SF	F	ASH	
Average	90.5	1.8	3.6	0.7	3.4	9.5	

SAMPLE NO: 85-C-29 Lower Freeport
 COMPANY: J.A. Thompson
 LOCATION: Glen Richey 7½ Quadrangle
 13,100' North 40° 55'
 9,900' East 78° 30'

inches	V	E	M	SF	F	ASH	
0-3		N.	A.			26.7	Canneloid
3-4½							Black Shale
4½-17	88.0	2.0	6.6	1.0	2.4	9.1	
17-17½							Clay
17½-30	90.4	2.0	3.2	0.2	4.2	5.4	
30-32½							Clay parting
32½-37	87.8	1.8	5.0	1.0	4.4	12.1	
	V	E	M	SF	F	ASH	
Average	89.0	2.0	4.9	0.6	3.5	8.0	

LOWER FREEPORT COALS

SAMPLE NO: 85-C-39 Lower Freeport

COMPANY: Thompson Strip mine
 LOCATION: Glen Richey 7½ Quadrangle
 12,300' North 40° 50'
 11,200' East 78° 30'

inches	V	E	M	SF	F	ASH	
0-5	82.6	10.4	7.0	—	—	18.7	Canneloid
5-11	83.8	3.4	6.0	2.2	4.6	5.1	
11-17	91.0	3.2	3.0	0.8	2.0	6.0	
							Black Shale
17½-29	90.6	2.4	3.6	2.2	1.2	5.7	
29-32½							
32½-34	85.6	2.4	5.4	1.6	5.0	24.7	
	V	E	M	SF	F	ASH	
Average	87.8	4.1	4.6	1.5	2.0	8.8	

SAMPLE NO: 85-C-53 Lower Freeport

COMPANY: mine - unknown
 LOCATION: Ramey Quadrangle
 7,500' North 40° 50'
 6,800' East 78° 25'

inches	V	E	M	SF	F	ASH	
0-6	75.8	2.6	8.8	4.6	8.2	5.5	
6-11	83.4	2.6	4.8	5.4	3.8	3.5	
							Fusain parting
11-16½	81.6	2.6	4.2	3.4	8.2	3.1	
							Carbonaceous shale
16½-22	89.4	1.6	5.2	0.8	3.0	3.6	
22-26½	91.2	1.6	3.2	0.8	3.2	5.7	
							Canneloid
27½-33½	93.2	3.2	1.2	1.0	1.4	4.2	
							Fusain and clay
33½-41½	93.0	3.6	2.0	1.4	—	4.0	
							Shaly parting
41½-47	92.6	2.2	2.0	1.0	2.2	3.9	
	V	E	M	SF	F	ASH	
Average	88.6	2.8	3.5	1.9	3.2	4.2	

LOWER FREEPORT COALS

SAMPLE NO: 85-C-62 Lower Freeport
 COMPANY: Strip mine near Gallager *
 Houtzdale 7½ Quadrangle
 LOCATION: 6,500' North 40° 50'
 3,200' West 78° 20'

inches	V	E	M	SF	F	ASH
0-5½	84.4	2.4	2.8	—	10.4	11.0
5½-7½	94.6	1.8	2.2	—	1.4	17.3
						Clay
7½-19	77.6	2.0	11.2	—	9.2	8.5
19-31	75.4	1.2	9.2	2.6	11.6	5.3
31-42	92.8	—	4.0	1.0	2.2	5.3
						Brown clay
42-47½	95.8	1.2	0.6	0.4	2.0	5.5
47½-61½	91.2	2.0	2.8	2.0	2.0	4.1
61½-69	96.0	1.8	1.2	—	1.0	6.3
	V	E	M	SF	F	ASH
Average	87.0	1.8	1.2	—	1.0	6.3

* Badly weathered at top of bed

SAMPLE NO: 85-C-86 Lower Freeport
 COMPANY: 3 B's
 Ramey 7½ Quadrangle
 LOCATION: 1,600' North 40° 45'
 9,300' West 78° 25'

inches	V	E	M	SF	F	ASH
0-5	92.0	2.2	2.4	0.8	2.6	6.7
5-11	90.0	3.4	2.8	0.4	3.4	5.0
11-14½	88.0	2.6	3.6	3.8	2.0	6.2
						Carbonaceous clay
14½-21½	94.2	0.6	1.8	0.4	3.0	8.3
21½-26	92.0	0.8	2.4	0.2	4.6	7.6
	V	E	M	SF	F	ASH
Average	91.5	1.9	2.5	0.9	3.2	6.8

LOWER FREEPORT COALS

SAMPLE NO: 85-C-58 Lower Freeport

COMPANY: unknown - underground mine

LOCATION: Ramey 7½ Quadrangle
2,100' North 40° 50'
1,000' West 78° 25'

inches	V	E	M	SF	F	ASH	
0-2½	89.0	2.2	7.0		1.8	13.8	
2½-9	94.6	0.8	2.4	1.0	1.2	6.1	
9-16	92.2	0.8	2.4	0.2	4.4	6.1	
16-21	93.8	1.0	1.8	0.2	3.2	3.8	
							Fusain and clay
21-27½	94.6	1.0	2.6		1.8	4.4	
27½-37½	88.4	3.0	2.8	0.6	5.2	6.2	Discontinuous Parting
	V	E	M	SF	F	ASH	
Average	91.9	1.6	2.8	0.4	3.3	6.1	

SAMPLE NO: 85-C-71 Lower Freeport

COMPANY: Elliot

LOCATION: Houtzdale 7½ Quadrangle
11,000' North 40° 50'
9,800' West 78° 20'

inches	V	E	M	SF	F	ASH	
0-2	Roof	Coal	Shaley				
2-4	92.0	4.6	3.0		0.4	4.6	
4-12	92.0	4.4	1.6	1.2	0.8	4.2	
12-18	88.4	4.0	2.0	1.2	4.4	19.4	
18-22	Dirty	Coal					
22-28	87.2	3.8	4.6	1.6	2.8	10.6	
	V	E	M	SF	F	ASH	
Average	87.2	4.1	2.7	1.2	2.3	10.1	

LOWER FREEPORT COALS

SAMPLE NO: 85-C-76 Lower Freeport

COMPANY: Strip mine - unknown

LOCATION: Houtzdale 7½ Quadrangle

2,800' South 40° 30'

8,700' West 78° 15'

inches	V	E	M	SF	F	ASH	
0-9	86.6	2.4	6.4	1.6	3.0	11.9	
9-13	79.5	6.5	11.0	1.0	2.0	24.6	Cannel
13-20	73.8	3.4	11.8	4.8	6.2	8.1	
20-24½	79.4	1.8	9.4	3.6	5.8	7.1	
24½-39	89.2	1.2	3.0	1.2	5.4	6.1	
39-42	92.0	0.8	2.2	1.4	3.6	6.1	Carbonaceous clay
42-56	92.8	2.2	1.4	0.8	2.8	6.0	
56-65	93.8	2.2	1.2	0.8	2.0	5.2	
65-75	94.6	1.4	1.0	0.6	2.4	7.9	
75-81	Coaly Shale						
	V	E	M	SF	F	ASH	
Average	88.3	2.2	4.3	1.5	3.7	8.2	

LOWER FREEPORT COALS

SAMPLE NO: 85-C-88 Lower Freeport

COMPANY: Strip mine - unknown
 LOCATION: Ramey 7½ Quadrangle
 11,700' North 40° 45'
 11,100' East 78° 25'

inches	V	E	M	SF	F	ASH	
0-1½	90.8	3.0	6.0	—	0.2	11.5	Pyrite parting
1½-7	94.2	3.0	2.6	—	—	8.6	
7-11	75.6	3.0	12.0	1.8	7.6	8.0	Carbonaceous shale
11-17½	89.2	2.4	5.8	—	2.6	6.2	
17½-22	92.0	2.0	3.8	—	2.2	5.9	Carbonaceous shale
22-30½	90.8	4.2	3.6	—	1.4	9.4	
	V	E	M	SF	F	ASH	
Average	89.4	3.1	5.1	0.2	2.2	8.0	

SAMPLE NO: 85-C-90 Lower Freeport

COMPANY: Ryan Bros.
 LOCATION: Richey 7½ Quadrangle
 1,500' South 40° 55'
 4,900' East 78° 30'

inches	V	E	M	SF	F	ASH	
0-6	88.6	3.8	5.6	0.6	1.4	6.3	
6-10½	77.4	2.2	1.2	1.6	17.6	7.1	
10½-18	83.8	4.2	5.8	1.8	4.4	7.2	
18-22	86.0	2.6	3.2	1.0	7.2	6.8	
	V	E	M	SF	F	ASH	
Average	84.2	3.4	4.3	1.3	6.8	6.9	

UPPER KITTANNING COALS

SAMPLE NO: 85-C-9 Upper Kittanning

COMPANY: Maple Hill Coal Co.

LOCATION: Richey 7½' quadrangle
3,300'S 41°00'
8,500'E 78°25'

Inches	V	E	M	SF	F	ASH
0 - 5	84.4	2.8	5.0	0.4	7.4	16.2
5 - 7	71.4	3.2	8.8	2.8	13.8	16.0
7 - 17	92.0	0.2	3.0	2.2	2.6	20.1
						black shale
17 - 27	88.2	-	4.0	1.6	6.2	22.7
27 - 29						black coaly shale
	V	E	M	SF	F	ASH
Average	87.5	0.9	4.2	1.7	5.7	19.9

SAMPLE NO: 85-C-20 Upper Kittanning

COMPANY: Maple Hill Coal Co.

LOCATION: Glen Richey 7½' quadrangle
3,200'S 41°00'
7,900'E 78°25'

Inches	V	E	M	SF	F	ASH
0 - 2						43.0
2 - 7	77.8	5.4	5.2	3.4	8.2	14.6
7 - 17	90.4	1.8	2.4	-	5.4	15.3
17 - 26	84.8	1.8	3.6	3.2	6.6	18.0
	V	E	M	SF	F	ASH
Average	85.8	2.6	3.4	1.9	6.3	16.2

SAMPLE NO: 85-C-42 Upper Kittanning

COMPANY: unknown

LOCATION: Wallaceton 7½' quadrangle
12,800'S 41°00'
3,900'W 78°20'

Inches	V	E	M	SF	F	ASH
0 - 6	77.8	3.0	4.0	2.0	13.2	17.4
6 - 12	92.4	3.2	1.8	0.4	2.2	8.0
	V	E	M	SF	F	ASH
Average	84.8	3.1	3.0	1.2	7.9	12.9

UPPER KITTANNING COALS

SAMPLE NO: 85-C-70 Upper Kittanning

COMPANY: Hansel

LOCATION: Houtzdale 7½' quadrangle
12,300'N 40°50'
9,700'W 78°20'

Inches	V	E	M	SF	F	ASH	
							mixed shale and coal
0 - 8½	71.4	4.2	4.8	1.4	18.2	7.4	
							fusain and clay
8½ - 13	80.8	7.0	2.8	0.4	9.0	7.9	
	V	E	M	SF	F	ASH	
Average	75.0	5.3	4.0	1.0	14.7	7.6	

SAMPLE NO: 85-C-77 Upper Kittanning

COMPANY: Elliot

LOCATION: Houtzdale 7½' quadrangle
4,800'S 40°50'
11,400'W 78°15'

Inches	V	E	M	SF	F	ASH	
0 - 5½	86.2	7.4	4.6	1.2	0.6	9.9	
							discontinuous clay
5½ - 14	95.6	2.6	1.4	-	0.4	6.8	
							clay and fusain
14 - 17½	90.0	4.0	1.0	0.6	4.4	14.3	
17½ - 18½	93.4	2.6	1.8	-	2.2	14.2	
	V	E	M	SF	F	ASH	
Average	91.5	4.3	2.4	0.5	1.3	9.5	

SAMPLE NO: 85-C-78 Upper Kittanning

COMPANY: Elliot

LOCATION: Houtzdale 7½' quadrangle
4,700'S 40°50'
11,400'E 78°20'

Inches	V	E	M	SF	F	ASH	
0 - 4	58.2	5.0	6.6	3.4	26.8	8.5	
4 - 11	73.4	5.8	5.4	2.0	13.4	5.9	
11 - 16	95.8	3.8	0.4	-	-	5.2	
	V	E	M	SF	F	ASH	
Average	76.6	5.0	4.1	1.7	12.6	6.3	

MIDDLE KITTANNING COALS

SAMPLE NO: 85-C-37 Middle Kittanning
 COMPANY: Wilks Strip
 LOCATION: Wallaceton $7\frac{1}{2}$ ' quadrangle
 $1,400'S 40^{\circ}55'$
 $1,300'W 78^{\circ}20'$

Inches	V	E	M	SF	F	ASH	
0 - 8							alternating coal and shale
8 - $12\frac{1}{2}$	86.2	2.4	2.0	0.8	8.6	23.0	fusain and clay
$12\frac{1}{2}$ - 19	93.6	1.4	3.4	0.4	.2	6.0	clay
19 - 27	87.8	3.4	2.4	-	6.4	6.4	
27 - 32	96.2	2.4	1.2	-	0.2	16.0	
32 - 50	97.8	1.2	0.8	-	0.2	5.6	
50 - 58	96.6	0.8	1.6	-	1.0	2.5	
	V	E	M	SF	F	ASH	
Average	94.5	1.7	1.6	0.1	2.1	7.9	

SAMPLE NO: 85-C-43 Middle Kittanning
 COMPANY: Maple Hill Coal Co.
 LOCATION: Wallaceton $7\frac{1}{2}$ ' quadrangle
 $14,500'S 41^{\circ}00'$
 $3,700'W 78^{\circ}20'$

Inches	V	E	M	SF	F	ASH	
0 - 7	75.8	8.6	8.0	2.2	5.4	5.9	canneloid
7 - 13	82.0	4.2	7.2	0.8	5.8	21.7	
13 - 18	90.2	2.8	3.2	.4	2.4	6.9	pyritic fusain
18 - 23	93.8	1.6	2.2	2.0	0.4	4.9	clay
$23 - 26\frac{1}{2}$	87.6	0.4	4.8	3.6	3.6	9.7	
	V	E	M	SF	F	ASH	
Average	84.6	4.3	5.5	1.8	3.8	10.1	

MIDDLE KITTANNING COALS

SAMPLE NO: 85-C-52 Middle Kittanning
COMPANY: Putnam-Greene
LOCATION: Ramey 7½' quadrangle
 3,800'N 40°50'
 800'E 78°25'

inches	V	E	M	SF	F	ASH	
0 - 4	92.6	1.8	2.6	0.4	2.6	7.7	
4 - 7½	86.4	4.0	3.2	1.8	4.6	3.3	
							coaly shale
7½ - 12	88.6	4.2	3.2	.4	2.6	3.4	sulfuritic clay parting
12 - 16	84.2	4.0	4.0	1.8	6.0	8.6	
							carbonaceous claystone
16 - 24	95.2	1.4	1.2		2.2	7.6	
							coaly shale
	V	E	M	SF	F	ASH	
Average	90.1	2.8	2.7	0.9	3.5	6.5	

SAMPLE NO: 85-C-54 Middle Kittanning
COMPANY: Henderson
LOCATION: Ramey 7½' quadrangle
 8,600'N 40°50'
 8,400'E 78°25'

inches	V	E	M	SF	F	ASH	
0 - 2	80.2	2.6	6.2	1.8	9.2	9.2	
2 - 6	76.2	5.6	5.8	3.8	8.6	4.2	
6 - 10	90.6	4.6	2.8	0.6	1.4	4.4	
10 - 13	78.8	3.6	4.8	3.2	9.6	4.9	
13 - 20	96.4	1.0	0.6	0.2	1.8	8.5	
20 - 24	92.0	1.0	5.0	-	2.0	7.4	
24 - 27½	91.2	1.6	2.8	0.4	4.0	7.8	
	V	E	M	SF	F	ASH	
Average	87.8	2.8	3.6	1.3	4.5	6.6	

MIDDLE KITTANNING COALS

SAMPLE NO: 85-C-63 Middle Kittanning
 COMPANY: Bonita #1 - Gallagher
 LOCATION: Houtzdale $7\frac{1}{2}$ ' quadrangle
 6,000'N 40°50'
 3,400'W 78°20'

inches	V	E	M	SF	F	ASH
0 - 7	89.2	6.0	2.2	0.2	2.4	6.1
7 - 15	94.2	4.0	1.2	0.6	-	6.7
15 - 24	96.6	.4	0.8	-	1.2	24.3*
						coaly shale
24 - 39	86.6	2.8	2.8	1.8	6.0	11.6
	V	E	M	SF	F	ASH
Average	90.4	3.5	2.0	0.9	3.2	11.6 (36")* 9.0 (30")

SAMPLE NO: 85-C-64 Middle Kittanning
 COMPANY: Elliot Coal Co.
 LOCATION: Houtzdale $7\frac{1}{2}$ ' quadrangle
 8,800'N 40°50'
 4,600'E 78°20'

inches	V	E	M	SF	F	ASH
0 - $3\frac{1}{2}$	85.6	9.2	2.4	0.8	2.0	4.5
						fusain and clay
$3\frac{1}{2}$ - 12	95.8	2.0	0.4	0.6	1.2	7.2
12 - 16	93.0	3.6	0.8	-	2.6	12.4
						very dirty and clayey coal
16 - 30	85.2	3.4	4.2	2.8	4.4	10.5
	V	E	M	SF	F	ASH
Average	90.4	3.8	2.0	1.2	2.6	8.7

MIDDLE KITTANNING COALS

SAMPLE NO: 85-C-65 Middle Kittanning
COMPANY: Elliot Coal Co.
LOCATION: Houtzdale 7½' quadrangle
 9,100'N 40°50'
 4,300'E 78°20'

inches	V	E	M	SF	F	ASH	
0 - 6	85.6	3.8	6.2	0.6	3.8	7.4	
6 - 11	88.6	2.4	6.4	0.4	2.2	8.1	
11 - 15	82.6	10.2	5.0	0.6	1.6	23.5	high ash with clay stringers
15 - 22	92.2	2.6	3.6	1.2	0.4	8.4	
	V	E	M	SF	F	ASH	
Average	87.8	4.3	5.2	0.7	2.0	10.8	

SAMPLE NO: 85-C-66 C Rider
COMPANY: Elliot Coal Co.
LOCATION: Houtzdale 7½' quadrangle
 8,900'N 40°50'
 4,300'E 78°20'

inches	V	E	M	SF	F	ASH	
0 - 4½	81.8	8.6	8.0	-	1.6	11.9	
4½ - 9	89.0	3.6	5.4	0.6	1.4	6.8	fusain and clay
9 - 18¼	94.2	4.8	0.6	-	0.4	3.3	
	V	E	M	SF	F	ASH	
Average	89.8	5.4	3.7	0.2	0.9	6.3	

LOWER KITTANNING COALS

SAMPLE NO: 85-C-2 Lower Kittanning
 COMPANY: unknown - near crop 3a
 LOCATION: Wallacetown 7½' quadrangle
 10,800' N 40°55'
 8,100' W 78°15'

	V	E	M	SF	F	ASH
0-12"						
	V	E	M	SF	F	ASH
Average	92.0	3.0	2.6	0.6	1.8	3.5

SAMPLE NO: 85-C-3 Lower Kittanning
 COMPANY: Maney Coal Company 3A,2
 LOCATION: Wallacetown 7½' quadrangle
 7,500' North 40°55'
 2,700' West 78°15'

inches	V	E	M	SF	F	ASH	
0 - 9	92.0	4.4	2.0		1.6	4.4	3A
9 - 18½	Carbonaceous Clay						
18½ - 24							
24 - 25							
25 - 35	86.5	4.3	4.7	0.9	3.6	9.1	2
35 - 45							
45 - 47½							
47½ - 49							Parting
	V	E	M	SF	F	ASH	
Average	87.8	4.3	4.1	0.7	3.1	8.0	

SAMPLE NO: 85-C-4 Lower Kittanning 3B
 COMPANY: Maney Coal Company
 LOCATION: Wallacetown 7½' quadrangle
 7,800' North 40°55'
 2,700' West 78°15'

inches	V	E	M	SF	F	ASH
0 - 9						
	V	E	M	SF	F	ASH
Average	88.0	5.8	5.0	0.2	1.0	16.5

LOWER KITTANNING COALS

SAMPLE NO: 85-C-14 Lower Kittanning
 COMPANY: Unknown Henderson N.
 LOCATION: Ramey 7½' quadrangle
 10,600' North 40°50'
 7,700' East 78°25'

inches	V	E	M	SF	F	ASH
0 - 2	88.6	3.8	5.6	—	2.0	23.6
2 - 9	90.2	2.8	4.4	1.4	1.2	8.2
9 - 11	93.4	6.3	0.3	—	—	10.3
	V	E	M	SF	F	ASH
Average	90.5	3.6	3.9	0.9	1.1	11.4

SAMPLE NO: 85-C-11 Lower Kittanning
 COMPANY: Company unknown
 LOCATION: Ramey 7½' quadrangle
 7,200'S 41°00'
 7,500'E 78°20'

inches	V	E	M	SF	F	ASH
0 - 3½	89.0	3.6	6.0		1.4	11.2
3½ - 6	94.6	2.6	2.4		0.4	10.6
6 - 10	92.4	2.2	3.4	1.2	0.8	6.1
10 - 12-3/4	96.4	2.2	1.2		0.2	6.2
	94.8	3.0	2.0		0.2	21.9
	V	E	M	SF	F	ASH
Average	92.7	2.7	3.5	0.4	0.7	9.2

pyritic fusain

SAMPLE NO: 85-C-13 Lower Kittanning
 COMPANY: unknown - Henderson
 LOCATION: Ramey 7½' quadrangle
 10,300'N 40°50'
 8,000'E 78°25'

inches	V	E	M	SF	F	ASH
0 - 2	85.4	6.2	6.8	0.4	1.2	13.1
2 - 6 ¾	87.8	5.8	5.4	0.4	0.6	4.7
7 - 13	86.8	4.0	7.0	1.0	0.8	3.9
13 - 14						47.4
14 - 17	94.4	1.6	1.8	—	2.2	7.5
	V	E	M	SF	F	ASH
Average	88.8	4.2	5.5	0.5	1.0	6.0

discontinuous clay

discontinuous clay

Boney coal

LOWER KITTANNING COALS

SAMPLE NO: 85-C-15 Lower Kittanning
 COMPANY: Unknown
 LOCATION: Ramey 7½' quadrangle
 10,800' North 40°50'
 7,500' East 78°25'

inches	V	E	M	SF	F	ASH	
0 - 4	91.0	5.0	3.4	—	0.6	19.2	
4 - 9	85.6	2.0	2.0	2.0	8.4	9.8	Prominent fusain band fusain and clay
9 - 13	75.6	1.0	4.6	2.4	16.4	15.4	
13 - 14							pyritic fusain
14 - 22	83.6	3.8	3.0	2.8	6.8	9.1	
							dark gray shale
	V	E	M	SF	F	ASH	
Average	84.2	3.1	3.1	2.0	7.6	12.3	

SAMPLE NO: 85-C-17 Lower Kittanning
 COMPANY: Unknown 2,3A
 LOCATION: Wallaceon 7½' quadrangle
 8,700' North 40°55'
 8,300' East 78°20'

inches	V	E	M	SF	F	ASH	
+2 - 0							coaly shale
0 - 3½	91.8	4.2	3.6	—	0.4	8.8	3a
3½ - 6	94.2	4.0	0.8	—	1.0	11.6	Pyritic
6 - 15							coaly clay - shale
15 - 20	84.0	4.6	5.8	1.4	4.2	12.0	Pyritic
20 - 26	79.6	6.6	5.4	1.4	7.0	9.5	2
26 - 27½						26.4	*
27½ - 33	86.0	3.0	4.6	0.6	5.8	10.6	
33 - 35							
35 - 42	87.4	3.4	3.8	2.0	3.4	15.4	
	V	E	M	SF	F	ASH	
Average	92.6	4.2	2.5	—	0.7	10.0	3 a
Average	83.9	4.5	4.9	1.4	5.3	12.0	2
Average	85.6	4.5	4.5	1.1	4.3	11.6	All

* Note- Excluded from totals

LOWER KITTANNING COALS

SAMPLE NO: 85-C-18 Lower Kittanning
 COMPANY: Unknown 3A
 LOCATION: Wallacetown 7½ Quadrangle
 8,700' North 40°55'
 8,300' East 78°20'

inches	V	E	M	SF	F	ASH
0 - 14						
	V	E	M	SF	F	ASH
Average	83.0	5.4	7.0	0.6	4.0	6.6

SAMPLE NO: 85-C-32 Lower Kittanning
 COMPANY: Unknown - near Kellytown 1
 LOCATION: Glen Richey 7½' quadrangle
 11,100' South 40°55'
 9,700' East 78°30'

inches	V	E	M	SF	F	ASH	
0 - 4½	79.8	3.8	5.6	1.8	9.0	10.9	
4½ - 7	88.6	2.8	3.6	0.8	4.2	12.6	fusain
7 - 8							carbonaceous shale
8 - 14	90.2	1.0	5.0	1.0	2.8	7.4	
14 - 21	89.4	1.2	4.8	0.4	4.2	7.1	discontinuous fusain
	V	E	M	SF	F	ASH	
Average	87.4	1.9	4.9	0.9	4.9	8.6	

SAMPLE NO: 85-C-33 Lower Kittanning
 COMPANY: Unknown - Kellytown 3A
 LOCATION: Glen Richey 7½' quadrangle
 11,200' South 40°55'
 10,000' East 78°30'

inches	V	E	M	SF	F	ASH
0 - 3	89.2	4.2	4.0	—	2.6	6.7
3 - 8	95.2	2.0	2.0	—	0.8	6.1
8 - 8½						
8½ - 14½	93.4	1.6	2.0	—	3.0	11.1
14½ - 16	91.2	3.6	2.8	0.2	2.2	12.4
	V	E	M	SF	F	ASH
Average	93.0	2.4	2.5	—	2.1	8.8

LOWER KITTANNING COALS

SAMPLE NO: 85-C-34 Lower Kittanning
 COMPANY: Unknown - near Jeffries School 3A
 LOCATION: Glen Richey 7½' quadrangle
 8,700' South 40°55'
 8,900' East 78°25'

inches	V	E	M	SF	F	ASH	
0 - 2	89.4	3.6	3.8	—	3.2	11.7	
2 - 12½	95.2	1.0	2.2	1.4	0.2	2.7	
12½ - 13½							brown clay
13½ - 17½	96.6	1.8	1.8	—	—	6.0	
17½ - 20	91.6	4.2	2.4	—	1.8	12.4	knife edge parting
	V	E	M	SF	F	ASH	
Average	94.4	1.9	2.3	0.7	0.7	5.8	

SAMPLE NO: 85-C-35 Lower Kittanning
 COMPANY: Wilkes Mine 2, 3A
 LOCATION: Wallaceton 7½' quadrangle
 7,800' North 40°55'
 2,700' West 78°15'

inches	V	E	M	SF	F	ASH	
0 - 1	85.2	2.8	6.2	0.8	5.0	12.3	
1 - 3							carbonaceous shale
3 - 14	89.8	3.6	3.0	2.2	1.4	4.5	3a
							clay
14 - 21½	95.0	1.4	2.6	—	1.0	9.2	
21½ - 28							clay with Stigmaria
28 - 33½	71.0	8.2	12.4	0.4	8.0	23.5	
33½ - 35	78.8	7.8	7.4	0.8	5.2	18.6	2
35 - 36						26.2	
36 - 38½	86.6	2.6	4.4	0.2	6.2	14.7	
38½ - 41½							carbonaceous shale with plant fossils
41½ - 47	85.6	2.8	2.2	3.8	5.6	10.7	
47 - 48							
48 - 50½	85.0	1.2	1.8	2.0	10.0	10.7	
	V	E	M	SF	F	ASH	
Average	91.5	2.8	3.0	1.3	1.4	6.6	3a
Average	80.5	4.7	6.1	1.7	7.0	16.0	2
Average	86.2	3.7	4.5	1.5	4.1	11.1	total

LOWER KITTANNING COALS

SAMPLE NO: 85-C-40 Lower Kittanning
 COMPANY: 1 mile S.W. of Bigler 3
 LOCATION: Wallaceton 7½' quadrangle
 9,700' South 41°00'
 2,400' East 78°20'

inches	V	E	M	SF	F	ASH	
0 - 4½	86.6	5.0	3.8	0.4	4.2	15.1	
4½ - 10	90.8	5.0	3.4	0.4	0.4	6.1	knife edge parting
10 - 20	87.2	5.6	2.2	2.6	2.4	5.4	3b
20 - 22	86.4	3.6	4.0	2.4	3.6	17.0	boney coal
22 - 28	91.2	3.6	3.2	0.4	1.6	8.2	3a
	V	E	M	SF	F	ASH	
Average	87.9	5.1	3.0	1.6	2.4	8.6	3b
Average	91.2	3.6	3.2	0.4	1.6	8.2	3a
Average	88.7	4.2	3.0	1.3	2.2	8.5	total

SAMPLE NO: 85-C-45 Lower Kittanning
 COMPANY: Unknown 3A
 LOCATION: Wallaceton 7½' quadrangle
 13,000' South 41°00'
 3,900' East 78°20'

inches	V	E	M	SF	F	ASH	
0 - 5	93.2	3.2	2.0	0.4	1.2	4.4	
5 - 10	94.2	3.8	0.6	—	1.4	2.6	fusain and clay
10 - 14	84.6	3.4	4.4	0.6	7.0	3.7	
14 - 20	91.6	3.0	3.6	0.2	1.6	4.4	
	V	E	M	SF	F	ASH	
Average	91.3	3.3	2.6	0.3	2.5	3.8	

LOWER KITTANNING COALS

SAMPLE NO: 85-C-46 Lower Kittanning

COMPANY: Moore Strip

2

LOCATION: Wallaceton 7½' quadrangle
 1,500' North 40°55'
 1,600' East 78°20'

inches	V	E	M	SF	F	ASH
0 - 1½	88.4	6.2	3.4	1.6	0.4	20.2
1½ - 5½	86.8	6.4	5.0	1.8	—	13.2
						pyritic
5½ - 12	82.0	4.8	5.4	2.4	5.4	13.8
12 - 13						
13 - 17½	87.4	1.0	3.2	1.8	6.6	12.3
17½ - 18½						thick fusain at top of parting
18½ - 26	92.8	2.6	1.8	0.6	2.2	10.7
	V	E	M	SF	F	ASH
Average	87.6	3.7	3.7	1.6	3.4	12.8

SAMPLE NO: 85-C-47 Lower Kittanning

COMPANY: Moore

3A

LOCATION: Wallaceton 7½' quadrangle
 1,500' North 40°55'
 1,000' East 78°20'

inches	V	E	M	SF	F	ASH
0 - 2	90.2	3.8	2.6	—	3.4	14.0
2 - 6	93.0	3.8	1.8	1.0	0.8	3.8
6 - 13	92.4	3.4	2.4	1.0	0.8	3.7
13 - 14						
14 - 17½	93.6	3.2	1.0	1.8	0.4	8.2
	V	E	M	SF	F	ASH
Average	92.5	3.5	2.0	0.9	1.1	5.9

SAMPLE NO: 85-C-48 Lower Kittanning

COMPANY: Moore

4

LOCATION: Wallaceton 7½' quadrangle
 1,900' North 40°55'
 900' East 78°20'

inches	V	E	M	SF	F	ASH
0 - 3	95.4	3.0	0.8	—	0.8	3.2
						weathered
3 - 9	93.2	5.4	1.2	—	0.2	3.6
	V	E	M	SF	F	ASH
Average	93.9	4.6	1.1	—	0.4	3.5

LOWER KITTANNING COALS

SAMPLE NO: 85-C-51 Lower Kittanning 1
 COMPANY: Company ? - Henderson Clay operation
 LOCATION: Ramey 7½' quadrangle
 14,000' North 40°50'
 3,200' East 78°25'

inches	V	E	M	SF	F	ASH
0 - 9	84.0	4.4	4.8	1.4	5.4	12.9
9 - 12	83.0	3.0	7.8	2.6	3.6	12.2
12 - 16	84.2	1.6	5.0	1.4	7.8	7.8
16 - 20	82.8	1.6	4.4	1.6	9.6	13.4
20 - 21½						
21½ - 25	85.6	2.4	4.6	3.0	4.4	13.6
	V	E	M	SF	F	ASH
Average	83.8	2.9	5.4	1.9	6.0	12.1

clay - shale

SAMPLE NO: 85-C-57 Lower Kittanning 3A
 COMPANY: Unknown
 LOCATION: Ramey 7½' quadrangle
 9,500' North 40°50'
 4,000' East 78°25'

inches	V	E	M	SF	F	ASH
0 - 4	89.2	7.0	3.2	—	0.6	11.0
4 - 5	96.4	2.4	0.8	—	0.4	5.0
5 - 9½	93.4	4.0	1.8	0.8	—	4.0
9½ - 15	88.8	1.8	4.8	1.6	3.0	4.7
15 - 18	93.0	1.4	1.8	1.6	2.2	8.1
18 - 19						
19 - 21½	97.6	1.8	0.6	—	—	6.2
	V	E	M	SF	F	ASH
Average	91.9	3.3	2.6	0.9	1.3	6.5

SAMPLE NO: 85-C-55 Lower Kittanning 1
 COMPANY: Unknown
 LOCATION: Ramey 7½' quadrangle
 9,500' North 40°50'
 4,000' East 78°25'

inches	V	E	M	SF	F	ASH
0 - 2						29.4
2 - 6	83.6	4.8	3.8	4.2	3.6	6.8
6 - 10½	92.8	1.6	2.8	1.4	1.4	5.9
10½ - 18	87.8	2.2	4.4	2.0	3.6	5.4
18 - 21	85.8	1.6	3.2	1.2	8.2	7.2
	V	E	M	SF	F	ASH
Average	87.8	2.5	3.7	2.2	3.8	6.1

SAMPLE NO: 85-C-59 Lower Kittanning 4
 COMPANY: Unknown
 LOCATION: Houtzdale 7½' quadrangle
 12,300' North 40°50'
 300' East 78°20'

inches	V	E	M	SF	F	ASH
0 - 1½	93.0	0.4	3.0	0.2	3.4	11.1
1½ - 5	95.2	3.0	1.6	—	0.2	4.3
5 - 7	91.4	3.0	2.4	0.4	2.8	5.0
7 - 11	98.4	1.2	0.4	—	—	8.5
	V	E	M	SF	F	ASH
Average	95.4	2.0	1.5	0.1	1.0	6.9

SAMPLE NO: 85-C-56 Lower Kittanning 2
 COMPANY: Unknown
 LOCATION: Ramey 7½' quadrangle
 9,500' North 40°50'
 4,000' East 78°25'

inches	V	E	M	SF	F	ASH
0 - 1	70.6	10.2	7.8	2.0	9.4	22.6
1 - 3	89.8	4.4	2.6	1.2	2.0	15.9
3 - 7	75.0	3.8	8.8	2.2	10.2	8.5
7 - 9	90.6	2.2	1.8	0.8	4.6	9.4
9 - 14	89.2	3.2	4.8	—	2.8	9.9
14 - 17½	90.2	3.0	2.6	1.8	2.4	12.7
	V	E	M	SF	F	ASH
Average	85.3	3.7	4.9	1.2	4.9	11.5

SAMPLE NO: 85-C-60 Lower Kittanning 3A
 COMPANY: Unknown
 LOCATION: Houtzdale 7½' quadrangle
 12,300' North 40°50'
 100' East 78°20'

inches	V	E	M	SF	F	ASH
0 - 3	87.8	3.0	2.6	1.2	5.4	14.1
3 - 3½						
3½ - 9	94.4	2.0	1.4	0.4	1.8	3.0
9 - 14½	90.4	3.2	3.2	1.6	1.6	3.0
14½ - 16	82.2	2.8	7.0	1.2	6.8	17.6
16 - 20½	91.8	4.6	0.4	0.4	2.8	5.0
20½ - 21						
21 - 23½	93.4	3.6	2.2	0.2	0.6	9.4
	V	E	M	SF	F	ASH
Average	91.1	3.2	2.3	0.8	2.6	6.6

carbonaceous c

knife edge clay

clay

LOWER KITTANNING COALS

SAMPLE NO: 85-C-67 Lower Kittanning
 COMPANY: Hansel 3A
 LOCATION: Houtzdale 7½' quadrangle
 12,800' North 40°50'
 10,900' West 78°20'

inches	V	E	M	SF	F	ASH	
0 - 2½	93.6	3.2	2.6	—	0.6	5.2	
2½ - 7	93.2	3.6	1.4	—	1.8	2.8	
7 - 14	92.0	3.6	3.4	—	1.0	2.4	
14 - 14½							coaly shale
14½ - 20	95.0	2.4	1.4	0.8	0.4	6.2	
20 - 20½							carbonaceous clay
20½ - 22	90.8	3.0	2.6	0.6	3.0	12.2	
	V	E	M	SF	F	ASH	
Average	93.1	3.2	2.3	0.3	1.1	4.5	

SAMPLE NO: 85-C-68 Lower Kittanning
 COMPANY: Hansel 4
 LOCATION: Houtzdale 7½' quadrangle
 12,900' North 40°50'
 10,400' West 78°20'

inches	V	E	M	SF	F	ASH	
0 - 4	90.6	6.6	1.2	0.4	1.2	4.0	
4 - 8	92.0	2.4	2.4	0.2	3.0	2.3	
8 - 11½	95.8	3.0	0.6	0.4	0.2	3.0	
	V	E	M	SF	F	ASH	
Average	92.8	4.0	1.4	0.3	1.5	3.1	

SAMPLE NO: 85-C-74 Lower Kittanning
 COMPANY: Davis Trucking 5
 LOCATION: Wallaceton 7½' Quadrangle
 7,100' South 40° 55'
 9,300' East 78° 20'

inches	V	E	M	SF	F	ASH	
0-3	85.4	2.4	3.8	0.2	8.2	15.0	
3-5	83.2	3.2	4.4	0.8	8.4	22.3	
5-9	90.2	2.0	2.0	1.6	4.2	16.9	
	V	E	M	SF	F	ASH	
Average	87.0	2.4	3.1	1.0	6.5	17.5	

LOWER KITTANNING COALS

SAMPLE NO: 85-C-69 Lower Kittanning
 COMPANY: Hansel 5
 LOCATION: Houtzdale 7½' quadrangle
 12,500' North 40°50'
 10,300' West 78°20'

inches	V	E	M	SF	F	ASH
0 - 4	91.0	1.2	2.2	4.6	1.0	10.3
4 - 8						
8 - 14	89.6	1.4	3.2	0.8	5.0	14.0
	V	E	M	SF	F	ASH
Average	90.2	1.3	2.8	2.3	3.4	12.5

silty lenses with
coaly interbeds

SAMPLE NO: 85-C-72 Lower Kittanning
 COMPANY: Davis Trucking Company 3A
 LOCATION: Wallaceeton 7½' quadrangle
 7,100' South 40°55'
 9,300' East 78°20'

inches	V	E	M	SF	F	ASH
0 - 1						
1 - 3	91.2	4.0	1.8	1.0	2.0	6.5
3 - 6	88.4	4.6	2.2	0.8	4.0	6.3
6 - 13	90.6	2.8	3.0	1.8	1.8	2.9
13 - 14½	90.4	3.4	1.6	3.2	1.4	8.1
14½ - 20	92.0	4.8	1.2	0.8	1.2	7.6
20 - 23	93.4	3.0	1.4	—	2.2	6.6
	V	E	M	SF	F	ASH
Average	91.0	3.7	2.1	1.2	2.0	5.6
0 - 13	90.2	3.4	2.6	1.4	2.4	4.4
lower 8½"	92.2	4.1	1.3	0.8	1.5	7.4

clay
clay
pyritic clay

SAMPLE NO: 85-C-73 Lower Kittanning
 COMPANY: Davis Trucking Company 4
 LOCATION: Wallaceeton 7½' quadrangle
 7,100' South 40°55'
 9,300' East 78°20'

inches	V	E	M	SF	F	ASH
0 - 1½	93.8	4.6	1.4	—	0.2	12.4
1½ - 5½	93.4	4.2	2.0	—	0.4	3.8
5½ - 8	89.8	7.2	2.6	0.2	0.2	3.5
8 - 12½	97.6	1.8	0.6	—	—	5.5
	V	E	M	SF	F	ASH
Average	94.2	4.0	1.5	0.1	0.2	5.4

LOWER KITTANNING COALS

SAMPLE NO: 85-C-75 Lower Kittanning
 COMPANY: Du Shan Mine
 LOCATION: Houtzdale 7½' Quadrangle
 4,600' N 40° 50'
 6,300' W 78° 15'

inches	V	E	M	SF	F	ASH	
0-6	84.2	8.8	4.8	0.6	1.6	13.8	3b?
6-15	90.0	3.2	3.0	1.6	2.2	4.5	
15-19	92.2	3.0	3.0	1.0	0.8	4.7	
19-24½	92.6	1.6	1.8	1.8	2.2	5.2	3a
24½-26							
26-31	95.6	0.8	0.6	0.8	2.2	10.8	
31-34	90.6	3.4	2.4	—	3.6	8.2	
Av 3a	92.0	2.4	2.2	1.2	2.2	6.3	
	V	E	M	SF	F	ASH	
Average	90.6	3.6	2.7	1.1	2.0	7.7	

SAMPLE NO: 85-C-80 Lower Kittanning
 COMPANY: Unknown
 LOCATION: Houtzdale 7½' Quadrangle
 8,800' N 40° 45'
 7,400' W 78° 20'

inches	V	E	M	SF	F	ASH	
0-6	89.4	2.4	4.6	0.8	2.8	5.0	
6-13	89.8	1.2	3.4	0.4	5.2	4.7	
13½-15½	92.2	3.6	2.6	0.8	0.8	12.0	Fusain parting
15½-20½		Claystone Parting					
20½-25½	81.4	5.2	6.6	1.6	5.2	16.0	
25½-30½	82.0	3.8	5.6	2.6	6.0	10.2	
31-37	90.4	0.6	2.0	1.4	5.6	9.0	Boney coal
37½-43½	86.6	2.0	4.0	2.2	5.2	16.5	Shale
43½-48½		Carb	Shale				
	V	E	M	SF	F	ASH	
Average	87.2	2.4	4.2	1.4	4.8	10.0	

LOWER KITTANNING COALS

SAMPLE NO: 85-C-81 Lower Kittanning
 COMPANY: Unknown 3A, 3B
 LOCATION: Houtzdale 7½' Quadrangle
 9,100' N 40° 45'
 7,600' W 78° 20'

inches	V	E	M	SF	F	ASH	
0-4	81.6	8.6	4.6	—	5.2	8.4	3B
4-14	91.8	3.4	1.8	0.2	2.8	5.2	pyritic
14-18	91.6	2.0	2.4	—	4.0	13.0	3A
	V	E	M	SF	F	ASH	
Average	89.5	4.2	2.6	0.1	3.6	7.6	

SAMPLE NO: 85-C-82 Lower Kittanning
 COMPANY: Unknown 3B
 LOCATION: Houtzdale 7½' Quadrangle
 9,200' N 40° 45'
 7,800' W 78° 20'

inches	V	E	M	SF	F	ASH	
0-4½	84.8	3.0	5.4	—	6.8	5.5	
4½-10½	86.2	5.2	4.0	1.6	3.0	4.2	
10½-14	94.8	3.4	0.8	—	1.0	4.0	pyritic
	V	E	M	SF	F	ASH	
Average	87.9	4.0	3.7	0.7	3.7	4.6	

SAMPLE NO: 85-C-01 Lower Kittanning
 COMPANY: Unknown 3A
 LOCATION: Glen Richey 7½' Quadrangle
 6,100' N 40° 55'
 3,800' W 78° 25'

inches	V	E	M	SF	F	ASH	
0-4	91.8	4.0	3.8	0.2	0.2	13.4	
4-15	95.4	1.8	2.0	—	0.8	3.7	
15-17							coaly shale
17-27	92.6	1.8	2.4	1.0	2.2	11.2	
	V	E	M	SF	F	ASH	
Average	94.0	2.2	2.5	0.3	1.0	7.5	

SAMPLE NO: 95-C-1 Lower Kittanning
 COMPANY: Unknown 3B, 3A
 LOCATION: Philipsburg 15' quadrangle
 14,300' N. 40° 55'
 2,200' E. 78° 15'

	V	E	M	SF	F	ASH	
0-4"	90.2	3.2	3.8	2.2	0.6	7.5	
4-7"	84.2	3.6	3.4	2.4	6.4	4.7	
7-13"	89.4	4.6	4.0	0.4	1.6	4.0	3B
13-19"	90.8	2.8	3.2	1.0	2.2	4.5	
19-23½"	94.4	2.2	1.0	0.6	1.8	9.9	3A
23½-25½"	95.4	3.4	0.2	0.8	0.2	22.0	
	V	E	M	SF	F	ASH	
Average	90.6	3.3	2.9	1.1	2.1	7.2	

CLARION COALS

SAMPLE NO: 85-C-6

Clarion 2

COMPANY: General Refractories
 LOCATION: Wallacetown 7½ Quadrangle
 7,100' North 40° 55'
 8,200' East 78° 20'

inches	V	E	M	SF	F	ASH
0-18						
	V	E	M	SF	F	ASH
Average	84.8	6.0	4.0	—	5.2	9.3

Coal 18" thick

SAMPLE NO: 85-C-10

Clarion 1

COMPANY: unknown
 LOCATION: Wallacetown 7½ Quadrangle
 7,200' South 41° 00'
 7,500' East 78° 20'

inches	V	E	M	SF	F	ASH
0-7	84.2	4.4	4.2	0.6	6.6	5.0
7-11	89.0	1.2	6.0	1.0	1.8	4.2
11-13	72.8	2.6	6.8	0.4	17.4	5.3
13-17½	91.6	4.2	3.4	—	0.8	4.4
17½-20	73.8	2.0	8.8	6.8	8.6	14.2
	V	E	M	SF	F	ASH
Average	84.4	3.3	5.3	1.3	5.7	5.9

SAMPLE NO: 85-C-26

Clarion 2

COMPANY: Crop - Haupt Heirs Well #1
 LOCATION: Wallacetown 7½ Quadrangle
 8,300' South 41° 00'
 7,700' West 78° 20'

inches	V	E	M	SF	F	ASH
0-3	90.0	5.2	4.4	—	0.4	4.1
3-9	84.2	6.8	6.2	0.6	2.0	9.6
9-15						30.4
15-19	89.6	2.2	5.6	—	2.6	11.9
19-20						
20-26	82.8	1.8	7.6	—	7.8	24.8
	V	E	M	SF	F	ASH
Average	85.8	4.0	6.2	0.3	3.7	14.0

Shaly coal parting

SAMPLE NO: 85-C-30

Clarion 2

COMPANY: unknown - near Kellytown
 LOCATION: Glen Richey 7½ Quadrangle
 11,100' South 40° 55'
 9,700' East 78° 30'

inches	V	E	M	SF	F	ASH
0-4	87.2	4.8	4.2	0.8	3.0	9.5
4-9	82.8	3.2	5.6	2.2	6.4	9.2
9-16	71.6	10.0	11.6	2.2	4.6	18.9
16-20	86.4	1.4	6.4	1.2	4.6	10.0
20-25	87.0	3.2	4.0	2.2	3.6	16.3
25-27						31.4
	V	E	M	SF	F	ASH
Average	81.7	5.1	6.9	1.8	4.5	13.5

Canneloid

Parting

CLARION COALS

SAMPLE NO: 85-C-31 Clarion 3
 COMPANY: Unknown near Kellytown
 LOCATION: Glen Richey 7½' quadrangle

inches	V	E	M	SF	F	ASH
0-9"						
	V	E	M	SF	F	ASH
Average						39.7

Boney coal

SAMPLE NO: 85-C-49 Clarion 1
 COMPANY: unknown
 LOCATION: Wallacetown 7½ Quadrangle
 7,900' South 41° 00'
 7,400' West 78° 15'

inches	V	E	M	SF	F	ASH
0-4	94.8	2.8	2.4	—	—	4.2
4-7	93.2	2.4	1.8	0.2	2.4	4.9
7-13	86.2	2.6	4.8	0.4	6.0	5.0
13-16	58.4	0.8	9.8	19.4	20.6	16.2
	V	E	M	SF	F	ASH
Average	84.1	2.3	4.7	2.2	6.7	6.9

Fusain and clay

SAMPLE NO: 85-C-41 Clarion 1
 COMPANY: unknown
 LOCATION: Wallacetown 7½ Quadrangle
 10,200' South 41° 00'
 2,600' East 78° 20'

inches	V	E	M	SF	F	ASH
0-4	98.2	6.0	2.0	1.2	1.6	7.9
4-10	93.4	2.6	0.6	0.4	3.0	4.5
10-17	89.0	4.0	2.2	0.8	4.0	4.4
17-24	85.6	2.4	3.0	—	9.0	4.6
	V	E	M	SF	F	ASH
Average	89.2	3.5	2.0	0.5	4.8	5.1

Parting

SAMPLE NO: 85-C-44 Clarion 1
 COMPANY: Thompson
 LOCATION: Wallacetown 7½ Quadrangle
 10,900' North 40° 55'
 9,800' West 70° 15'

inches	V	E	M	SF	F	ASH
0-4	87.2	5.4	4.0	1.8	1.6	8.5
4-8	93.4	2.0	2.0	1.2	1.4	5.2
8-12	85.8	2.4	4.8	0.4	6.6	5.7
	V	E	M	SF	F	ASH
Average	88.8	3.3	3.6	1.1	3.2	6.5

SAMPLE NO: 85-C-79 Clarion 1, 2, & 3
 COMPANY: Elliot
 LOCATION: Houtzdale 7½ Quadrangle
 7,800' South 40° 50'
 11,400' East 78° 20'

inches	V	E	M	SF	F	ASH
0-10	77.0	7.0	8.4	3.2	4.4	8.3
10-11						
11-20	82.6	2.4	5.6	1.0	8.4	6.6
20-32	83.0	3.0	5.4	1.2	7.4	9.4
32-33½						
32½-48½	90.0	1.8	4.6	—	3.6	12.8
48½-57½	88.0	2.4	4.0	2.4	3.2	10.2
57½-58½						
58½-63½	95	2.2	1.4	—	0.6	8.1
	V	E	M	SF	F	ASH
Average	85.5	3.1	5.2	1.3	4.9	9.7

Carbonaceous shale

Clay

Pyritic fusain

MERCER COALS

SAMPLE NO: 85-C-5 Mercer - upper bed

COMPANY: General Refractories
 LOCATION: Wallaceton 7½ Quadrangle
 6,900' North 40° 55'
 8,100' East 78° 20'

inches	V	E	M	SF	F	ASH
0-8	77.5	2.2	4.9	3.6	11.8	10.9
8-10						Shaly coal
10-20	75.0	3.4	14.0	2.6	5.0	11.0
	V	E	M	SF	F	ASH
Average	76.1	2.9	10.0	3.0	8.0	11.0

SAMPLE NO: 85-C-36 Mercer - lower bed

COMPANY: Harbison Walker
 LOCATION: Wallaceton 7½ Quadrangle
 5,900' South 40° 55'
 4,000' West 78° 20'

inches	V	E	M	SF	F	ASH
0-5	91.2	3.2	1.2	—	4.4	14.3
5-11						Gray clay shale with plant fossils
11-11¾	97.4	2.0	0.4		0.2	24.2
11¾-15						Carbonaceous shale with Canneloid triletes
15-17	82.2	2.8	8.8	10.2	7.2	17.4
17½-24	71.0	2.8	8.8	10.2	7.2	17.4
24-25						Pyrite, fusain parting
25-27	76.4	1.2	4.2	3.4	14.8	23.4
	V	E	M	SF	F	ASH
Average	80.3	2.7	5.1	4.8	7.1	16.5

SAMPLE NO: 85-C-50 Mercer - lower bed

COMPANY: unknown
 LOCATION: Glen Richey 7½ Quadrangle
 10,200' South 40° 55'
 2,400' West 78° 25'

inches	V	E	M	SF	F	ASH
0-2	87.0	2.4	5.0	1.8	3.8	14.5
2-5	74.6	4.6	15.4	2.6	2.8	12.0
5-9	78.6	4.6	9.0	4.4	3.4	8.9
9-14	80.2	4.6	6.2	1.4	7.6	10.8
	V	E	M	SF	F	ASH
Average	79.5	4.3	8.8	2.6	4.8	11.0

